DEPARTMENTAL SYSTEMS AND SOFTWARE DIRECTIONS

INPUT

About INPUT

INPUT provides planning information, analysis, and recommendations to managers and executives in the information processing industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions. Continuing services are provided to users and vendors of computers, communications, and office products and services.

The company carries out continuous and in-depth research. Working closely with clients on important issues, INPUT's staff members analyze and interpret the research data, then develop recommendations and innovative ideas to meet clients' needs. Clients receive reports, presentations, access to data on which analyses are based, and continuous consulting.

Many of INPUT's professional staff members have nearly 20 years' experience in their areas of specialization. Most have held senior management positions in operations, marketing, or planning. This expertise enables INPUT to supply practical solutions to complex business problems.

Formed in 1974, INPUT has become a leading international planning services firm. Clients include over 100 of the world's largest and most technically advanced companies.

Offices

NORTH AMERICA

Headquarters
1943 Landings Drive
Mountain View, CA 94043
(415) 960-3990
Telex 171407

New York
Parsippany Place Corp. Center
Suite 201
959 Route 46 East
Parsippany, NJ 07054
(201) 299-6999
Telex 134630

Washington, D.C.
8298 C, Old Courthouse Rd.
Vienna, VA 22180
(703) 847-6870

EUROPE

United Kingdom
INPUT
41 Dover Street
London W1X 3RB
England
01-493-9335
Telex 27113

Italy
Nomos Sistema SRL
20124 Milano
Viale Vittorio Veneto 6
Italy
228140 and 225151
Telex 321137

Sweden
Athena Konsult AB
Box 22232
S-104 22 Stockholm
Sweden
08-542025
Telex 17041

ASIA

Japan
ODS Corporation
Dai-ni Kuyo Bldg.
5-10-2, Minami-Aoyama
Minato-ku,
Tokyo 107
Japan
(03) 400-7090
Telex 26487

INPUT®
Planning Services For Management

DEPARTMENTAL SYSTEMS AND SOFTWARE DIRECTIONS

NOVEMBER 1986

Published by
INPUT
1943 Landings Drive
Mountain View, CA 94043
U.S.A.

Information Systems Program (ISP)

Departmental Systems and Software Directions

DEPARTMENTAL SYSTEMS AND SOFTWARE DIRECTIONS

ABSTRACT

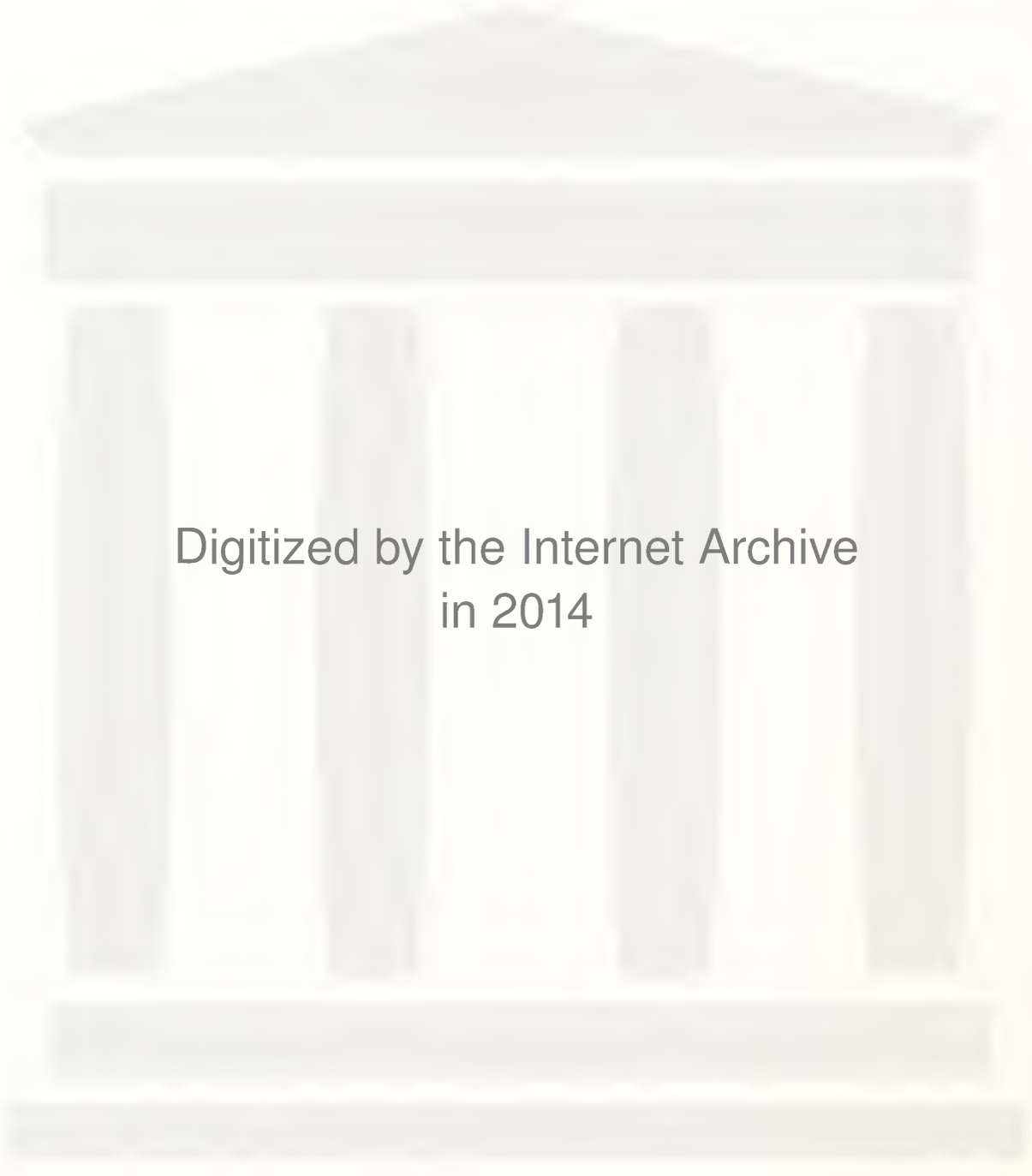
Departmental systems are now emerging as one of the major computer industry issues of the 1980s. Evolving as the crucial middle tier of a three-tier computing hierarchy consisting of corporate, departmental, and personal level automation, these systems are fast becoming the critical link that brings groups of workers in direct contact with the corporate information they need to function more productively.

This report analyzes the characteristics, potential, and directions of departmental systems during the next five years, with special emphasis on software. In addition to discussions of broad market trends, a number of individual user and vendor activities are highlighted. Implications for information systems strategies are provided, as well as recommendations for action.

This report contains 170 pages, including 39 exhibits.

DEPARTMENTAL SYSTEMS AND SOFTWARE DIRECTIONS

CONTENTS



EXHIBITS

1 INTRODUCTION

I INTRODUCTION

- This report is produced as one of a series of reports in INPUT's Information Systems Program (ISP).

A. PURPOSE

- Departmental systems are evolving into one of the most significant computer industry developments of the decade. This middle segment of the three-tiered computing hierarchy of corporate, departmental, and personal level automation has historically been much maligned, with microcomputers most often cited as the destroyer of the concept of midrange systems. However, increasing user automation sophistication combined with top management enlightenment and major price/performance advances in both computers and communications have resulted in a major resurgence of interest in locally dedicated, multiuser systems. Progressive departmental systems implementers have discovered that carefully designed approaches, with emphasis on connectivity to both mainframes and micros, can return major benefits.

- This report reviews and analyzes the challenges and opportunities of departmental systems with special attention placed on departmental software.

- This study is designed to assist information systems planners in:
  - Identifying application opportunities.
  - Assessing implementation payoffs and risks.
  - Allocating resources.

B. SCOPE

- The term "departmental systems" is central to the analysis contained within this report, yet its meaning within the computer industry is by no means precise. For this reason, INPUT has sought to carefully define the concept of departmental systems, as used in this study. In addition to the definitions below, other sections in this report discuss its scope and boundaries (see Section II.A).

1. DEFINITIONS

- WORK GROUP - Three or more people performing a common task.
- DEPARTMENT - One or more work groups performing interrelated tasks within a unit that is part of a larger organization. A department, by definition, must be supervised by a full-time manager.
- DEPARTMENTAL SYSTEMS - A combination of hardware and software systems which exist primarily to address the needs of the using department and which utilize multiuser hardware.

- Hardware aspects:

  . Examples include minicomputers, multiuser supermicros, PC-based networks, and micro-mainframe systems where the end user has significant local processing capacity and control.

  . Excluded from the definition of departmental systems are standalone microcomputers and dumb terminals connected to central mainframes. Also excluded from the definition are multiuser systems, no matter what their size, that function as a company's primary host computer.

- Software aspects--software applications for departmental systems are classified by INPUT into three types:

  . GENERIC - Applications that address a common function independent of the user's department or industry. Examples are spreadsheet and word processing.

  . DEPARTMENT-SPECIFIC - Applications that are unique to specific types of departments, but are not unique to different industries; for example, a payroll system.

  . INDUSTRY-SPECIFIC - Applications that are unique to a specific industry. Examples include check processing systems for banks and materials planning systems for manufacturers.

- INTEGRATED APPLICATIONS - Applications that incorporate functions previously processed as separate, distinct programs. Integrated applications involve multiple levels with characteristics such as a common command structure, data access from multiple functions, and smooth user transfer between functions.

- A single integrated application may include multiple generic, departmental-specific, and/or industry-specific functions.

- Examples of integrated applications include accounting systems incorporating general ledger, payroll, and accounts receivable, as well as multifunction office systems such as DEC's All-in-1 or Data General's CEO.

- Additional definitions related to this report may be found in Appendix A.

2. ORGANIZATION

- This report is organized as follows:

  - Chapter II is an Executive Summary provided in presentation format, complete with script.

  - Chapter III includes a discussion of user needs and decision methods as well as an applications analysis. Several case studies are also included.

  - Chapter IV reviews the competitive structure of the marketplace.

  - Chapter V recaps selected technology developments.

  - Chapter VI provides conclusions and recommendations.

  - Appendix A contains a set of definitions relevant to this report.

  - Appendix B presents an analytical framework to assist departmental systems planners.

  - Appendices C and D provide a sample of the user and vendor questionnaires, respectively.

- Appendix E lists other INPUT reports relevant to the topics discussed in this report.

- Exhibit I-1 on the following page illustrates the classification scheme used by INPUT to structure software application areas. Readers will find this chart helpful in understanding which applications are included in the forecasts contained in this report.

C. RESEARCH METHODOLOGY

- The process of forecasting is a continuous one. Two fundamental and complementary approaches are used to analyze the industry.

  - The first approach requires a constant interface through formal and informal interviews and contacts with buyers in each of the industries surveyed.

  - The second approach requires an ongoing monitoring of vendors with annual revenues greater than $10 million. Stratified random sampling techniques are employed to estimate the size and change in that portion of the industry represented by smaller firms.

- At the convergence of these two processes, INPUT researchers analyze industry size, composition, change, direction, etc. to generate the forecasts included in this report.

- In undertaking this study, 84 users and 16 vendors were interviewed. A profile of the users is presented in Exhibits I-2 through I-6. Industries represented by the companies interviewed were roughly proportional to those found in the U.S. economy overall.

EXHIBIT I-1

SOFTWARE MARKET STRUCTURE

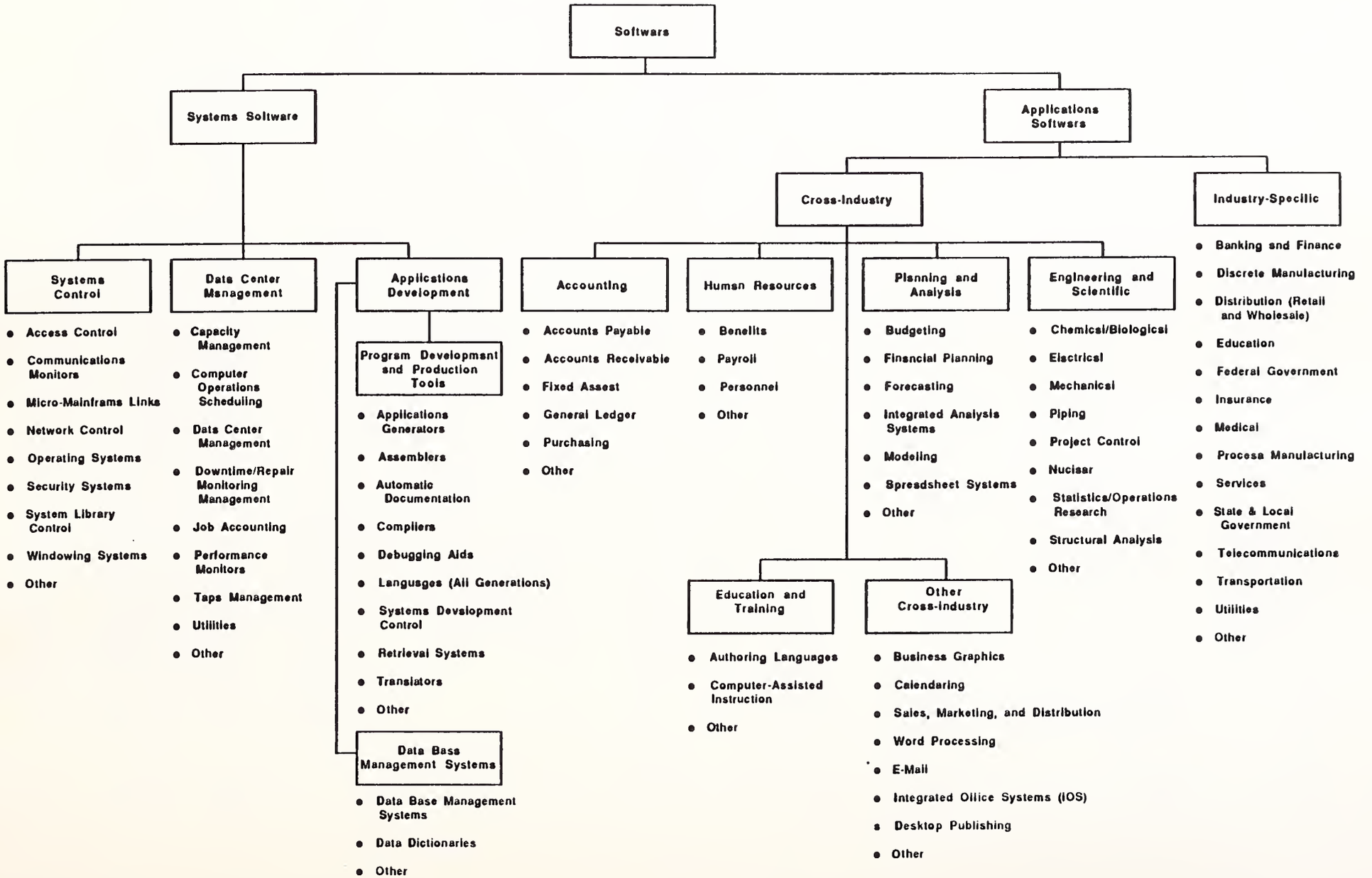
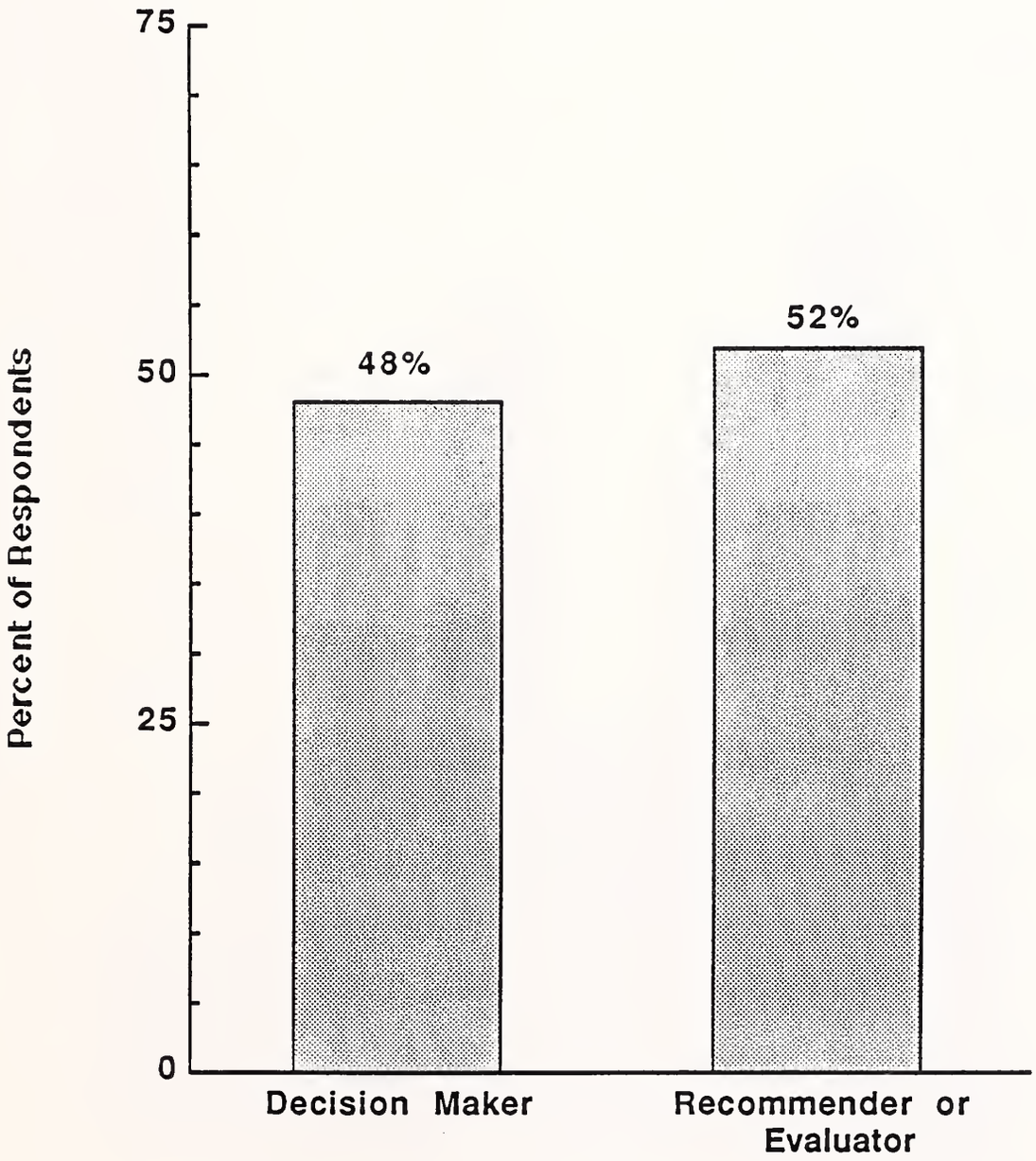


EXHIBIT I-2

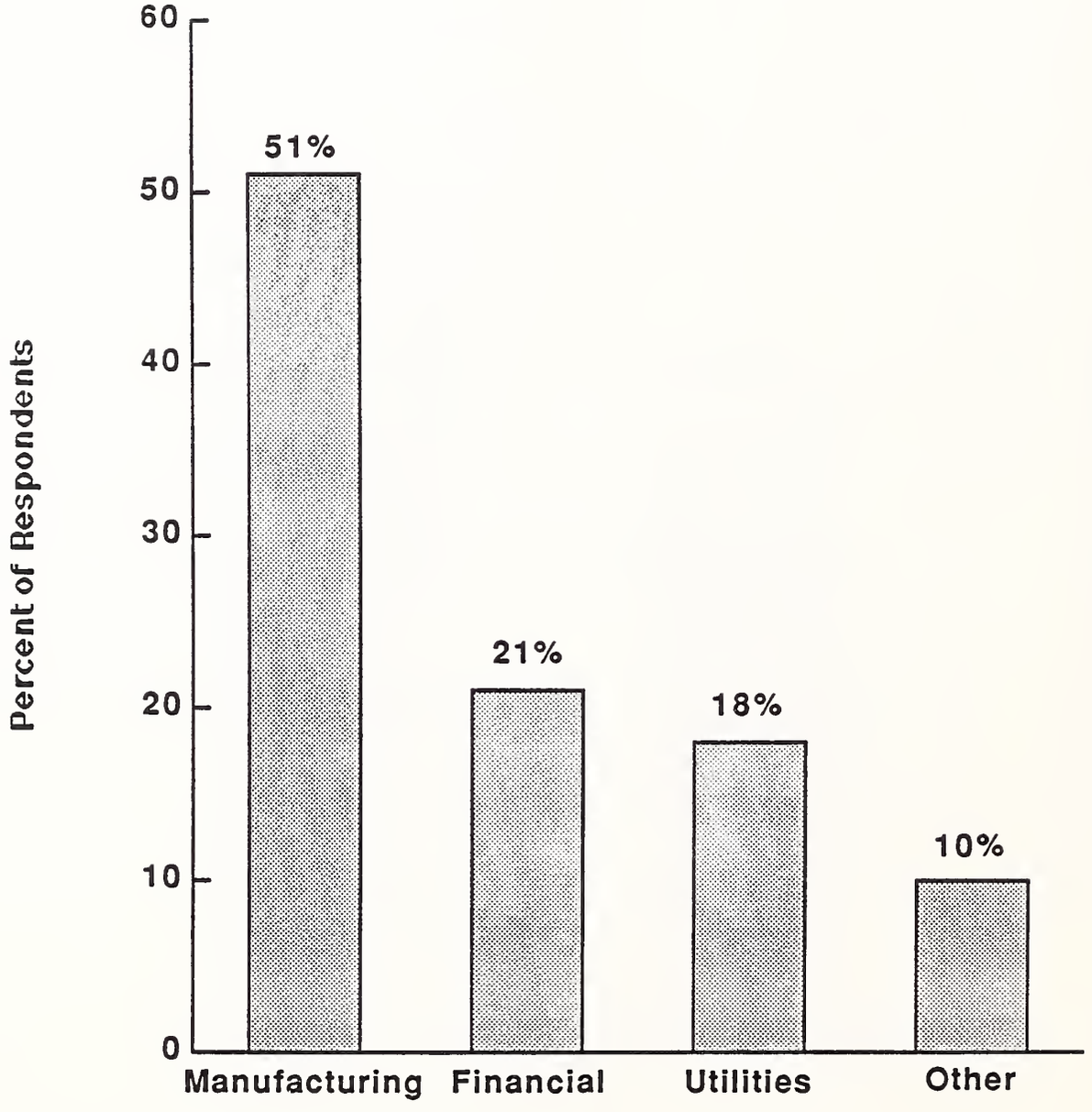
RESPONDENT PROFILE BY TYPE OF DECISION PARTICIPANT



MSP3Jz

EXHIBIT I-3

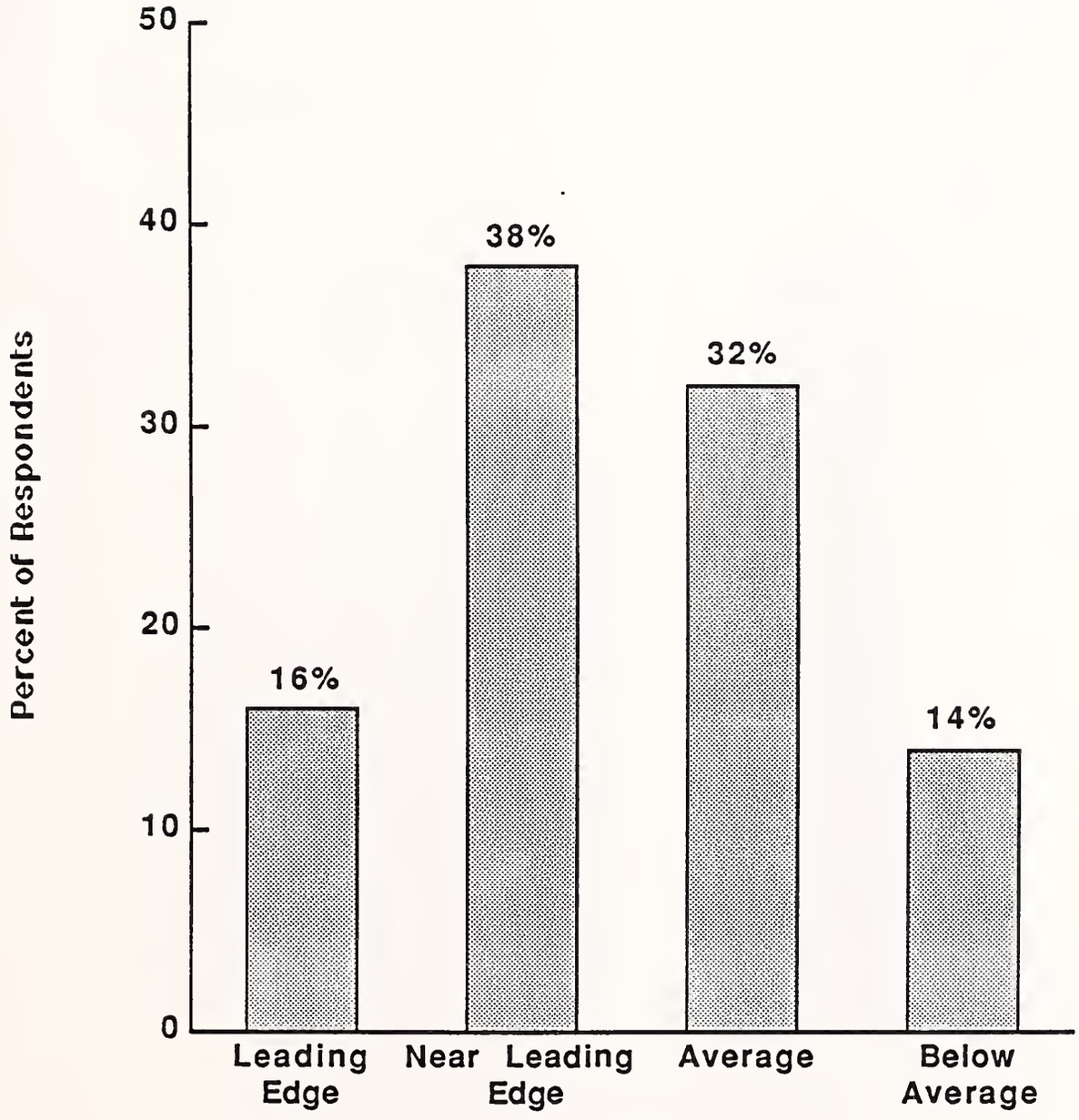
RESPONDENT PROFILE BY INDUSTRY



MSP3Jz

EXHIBIT I-4

RESPONDENT PROFILE BY EXTENT OF USE OF DEPARTMENTAL SYSTEMS

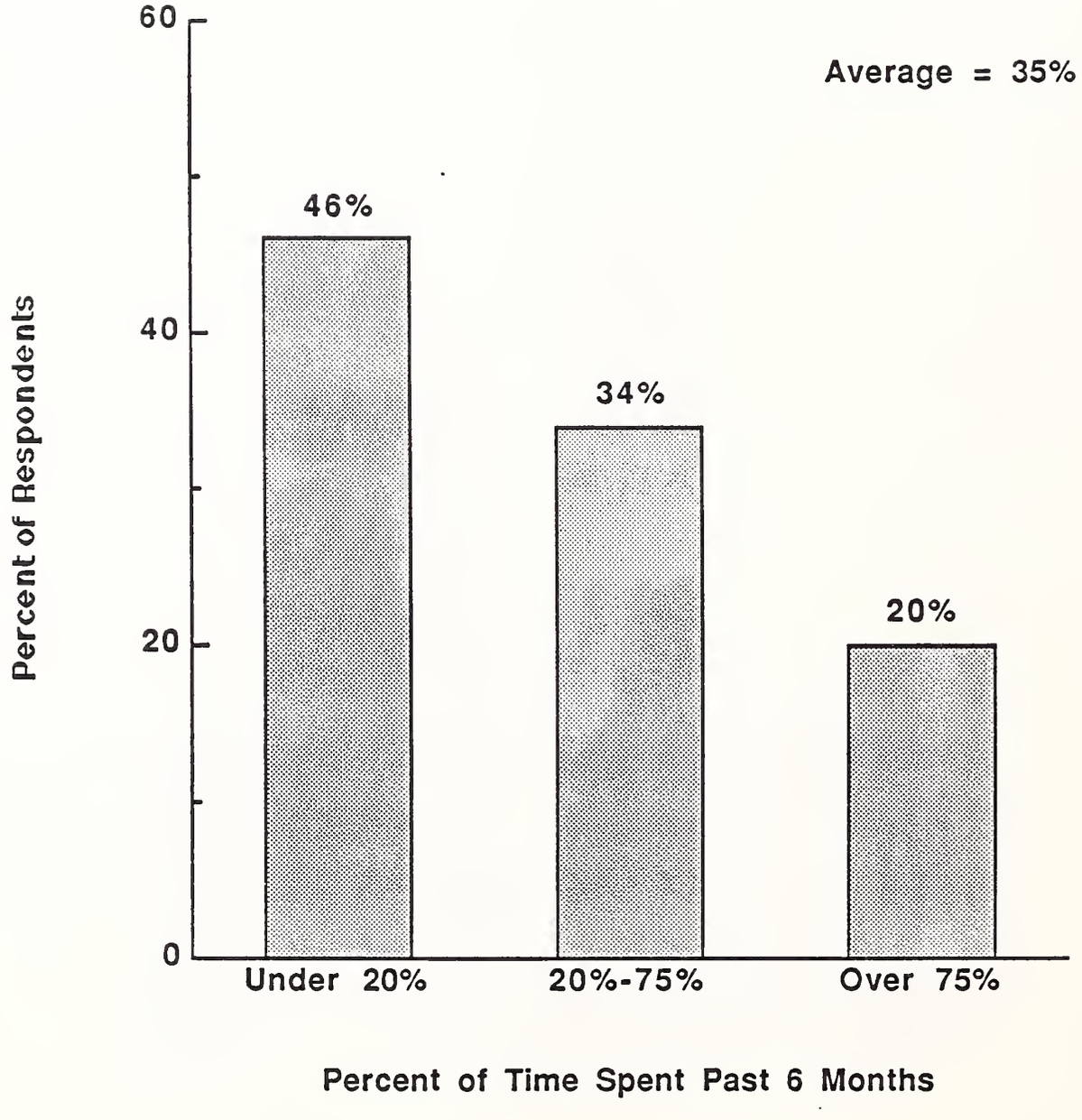


MSP3Jz

INPUT

EXHIBIT I-5

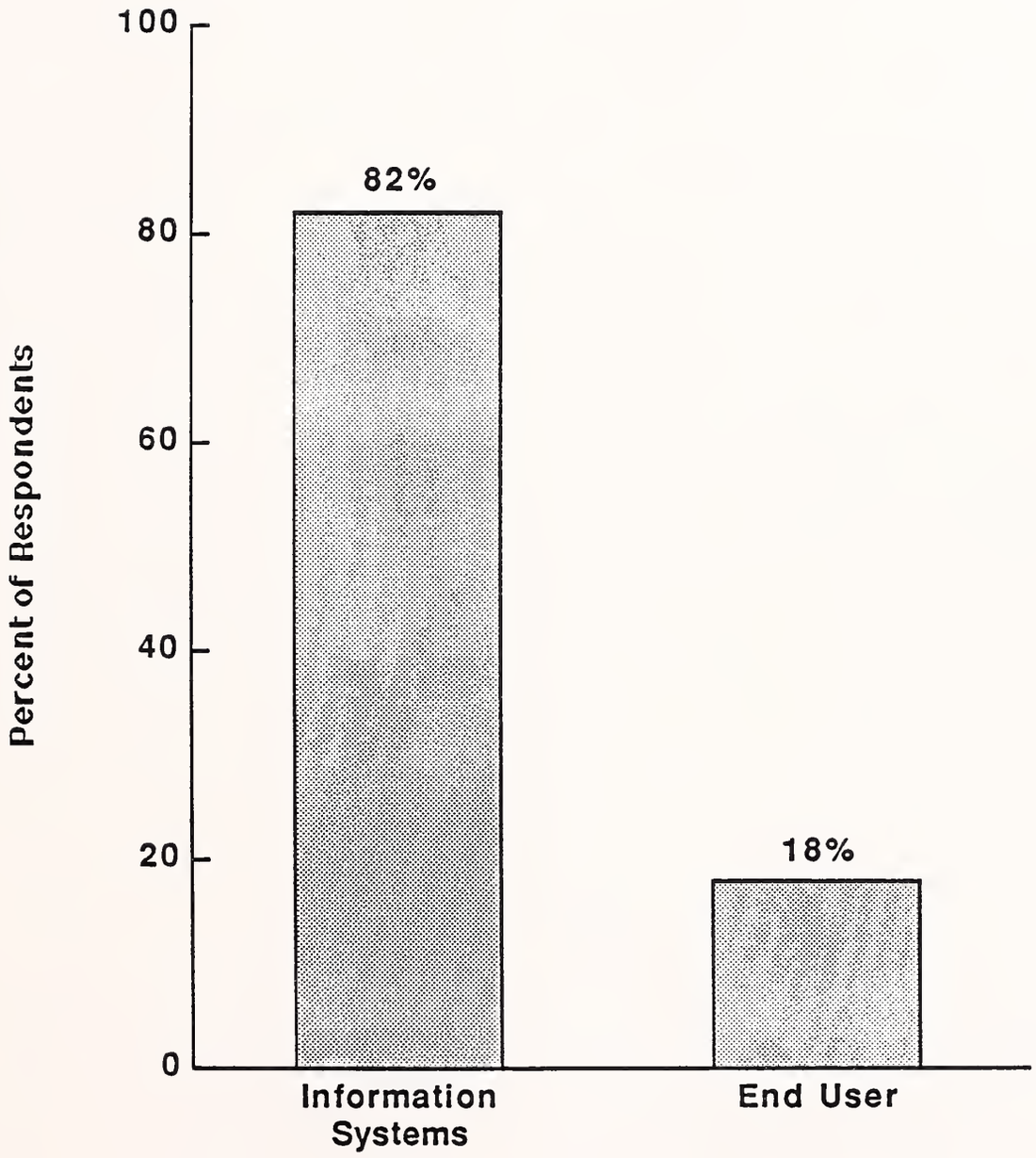
RESPONDENT PROFILE - TIME SPENT ON DEPARTMENTAL SYSTEMS ISSUES



MSP3Jz

EXHIBIT I-6

RESPONDENT PROFILE
BY TYPE OF DEPARTMENT



MSP3Jz

- Emphasis in the interview process was placed on talking to personnel most responsible for evaluating, recommending, or approving specific departmental systems solutions for their organization. In a vast majority of the cases, this turned out to be information systems personnel.

II EXECUTIVE SUMMARY

II EXECUTIVE SUMMARY

- This chapter summarizes key forecasts, issues, and trends that are discussed in more detail in the remainder of the report.

- This Executive Summary is prepared in a presentation format; i.e., the exhibits are set in larger type for ease of use with an overhead projector and the text is in script form. The script for each exhibit is contained on the left-hand page opposite the exhibit.

A. DEPARTMENTAL SYSTEMS—WHAT THEY ARE AND ARE NOT

- Departmental systems have recently gained center stage in terms of volume of user/vendor discussions, plans, and concerns. After more than 20 years of conceptualizing, experimenting, advancing, and retreating, the idea of departmental systems as a viable middle tier of computing between the mainframe and the workstation is now solidifying.

- INPUT defines a department as an organizational entity which is headed by a full-time manager and is comprised of one or more work groups which perform interrelated tasks. (A work group is three or more people performing a common task.) INPUT makes a distinction between departmental computing and departmental systems; departmental computing encompasses any type of automation that is used by departmental personnel. All of the options contained in the department "B" box in Exhibit II-1 are considered "departmental computing."

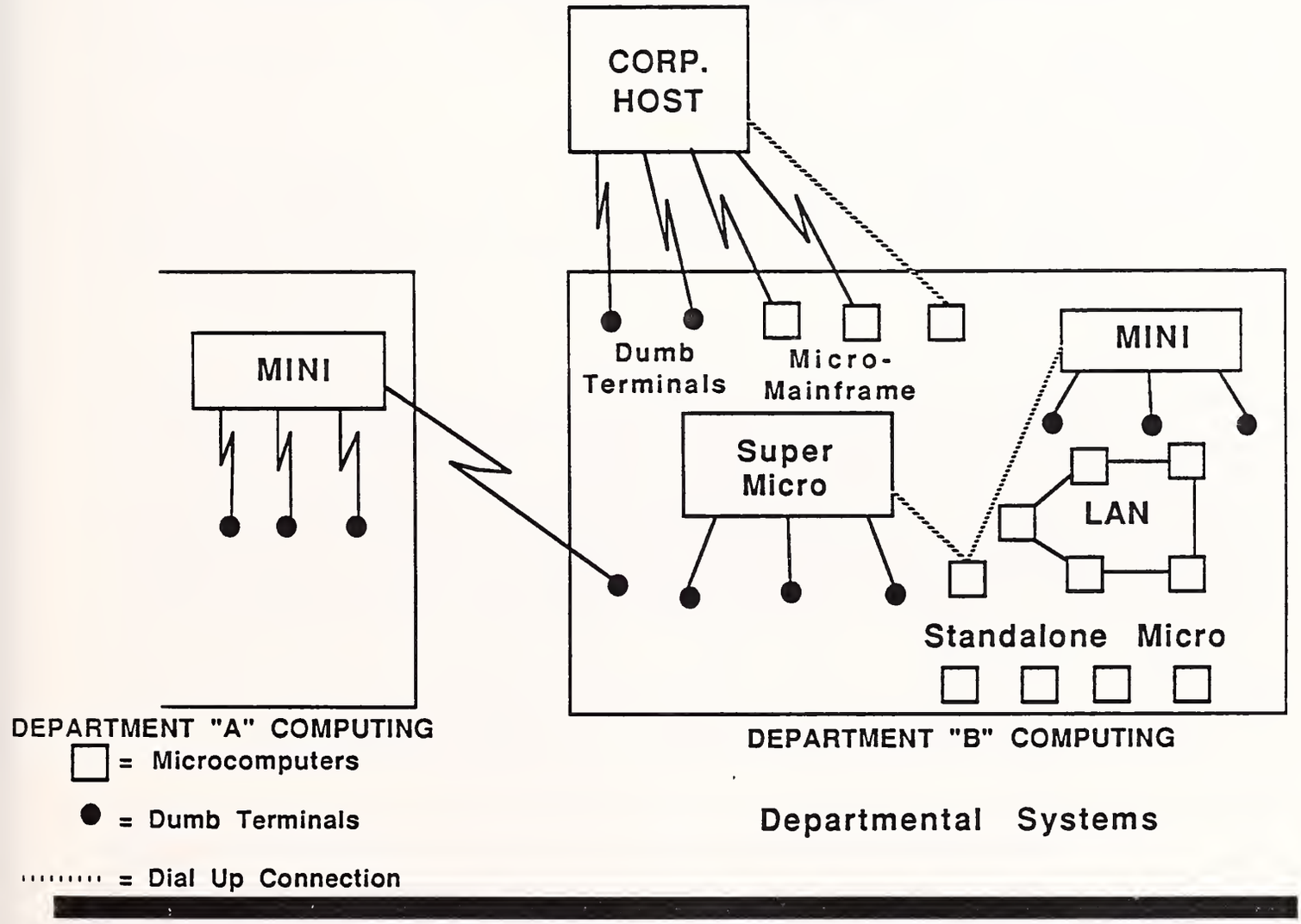
  - Departmental systems, however, are defined specifically as computer processors that have multiuser facilities and which are primarily dedicated to the needs of a specific department. Departmental systems are often department controlled, but do not have to be for inclusion in the definition. Departmental systems include mini-computers, multiuser supermicros, PC-based local area networks (LANs), and micro-mainframe connections where significant local processing is done at the micro level.

  - Excluded from the definition of departmental systems are standalone micros and dumb terminals connected to remote mainframes. Exhibit II-1 illustrates the relationship between departmental systems and departmental computing.

- The software for departmental systems is composed of generic, department-specific, and industry-specific software.

INPUT®

DEPARTMENTAL SYSTEMS
WHAT THEY ARE AND ARE NOT



Departmental Systems

B. DEPARTMENTAL SYSTEMS' CAPACITY TO EXPAND SIXFOLD

- INPUT estimates that departmental systems (as illustrated in the shaded area of Exhibit II-2) currently account for about 25% of all computing capacity, as approximated by total MIPS (millions of instructions per second). By 1991, this share will double to 50% of a base which is three times larger than today. As a result, the computing capacity of departmental systems will increase sixfold during this five-year period--a 43% average annual growth rate.

- This impressive growth is in contrast to a 12% annual increase predicted for standalone micro capacity growth and a 19% annual increase for dumb terminals connected to remote (i.e., outside of the using department) mainframes.

- Factors contributing to the rapid expansion of departmental systems capacity include:

  - Grass-roots demand from PC-skilled end users for increased power and easier access to organizational information and computing resources.

  - Top-down demand due to corporate management's push for systems with major strategic payoffs. These systems typically require increased information flow among formerly isolated work groups.

  - Major price/performance improvements that result in mainframe power being brought down to minis and mainframe/mini power down to micros.

  - Advances in communications technology which, when combined with enhanced vendor cooperation regarding standards, provide a major opportunity for cost-effective transporting and sharing of remote information.

DEPARTMENTAL SYSTEMS' CAPACITY TO EXPAND SIXFOLD

TYPE	COMPUTING CAPACITY INDEX		
	1986	1991	AAGR
Remote Mainframes Dumb Terminals	.25	.60	19%
Micro Mainframe Dept. Mini or Supermicro PC-Based LAN	.25	1.50	43%
Standalone Micro	.50	.90	12%
Total MIPS Index	1.00	3.00	25%

= Dept. Systems

C. FORTUNE 1000 DEPARTMENTAL SOFTWARE PRODUCTS TO EXCEED $7 BILLION

- Fortune 1000-sized firms will increase their usage of departmental software products by 32% annually for the next five years, as illustrated in Exhibit II-3. By 1991, more than $7 billion will be spent--up from almost $2 billion in 1986. Approximately two-thirds of this expenditure will be for applications software, a majority of which will be industry-specific.

- This impressive growth in software usage is more than one-half again as great as the 19% rate of growth to be enjoyed by the software products marketplace overall during this same time period.

- Reasons why Fortune 1000 departmental software will exceed the overall market growth include:

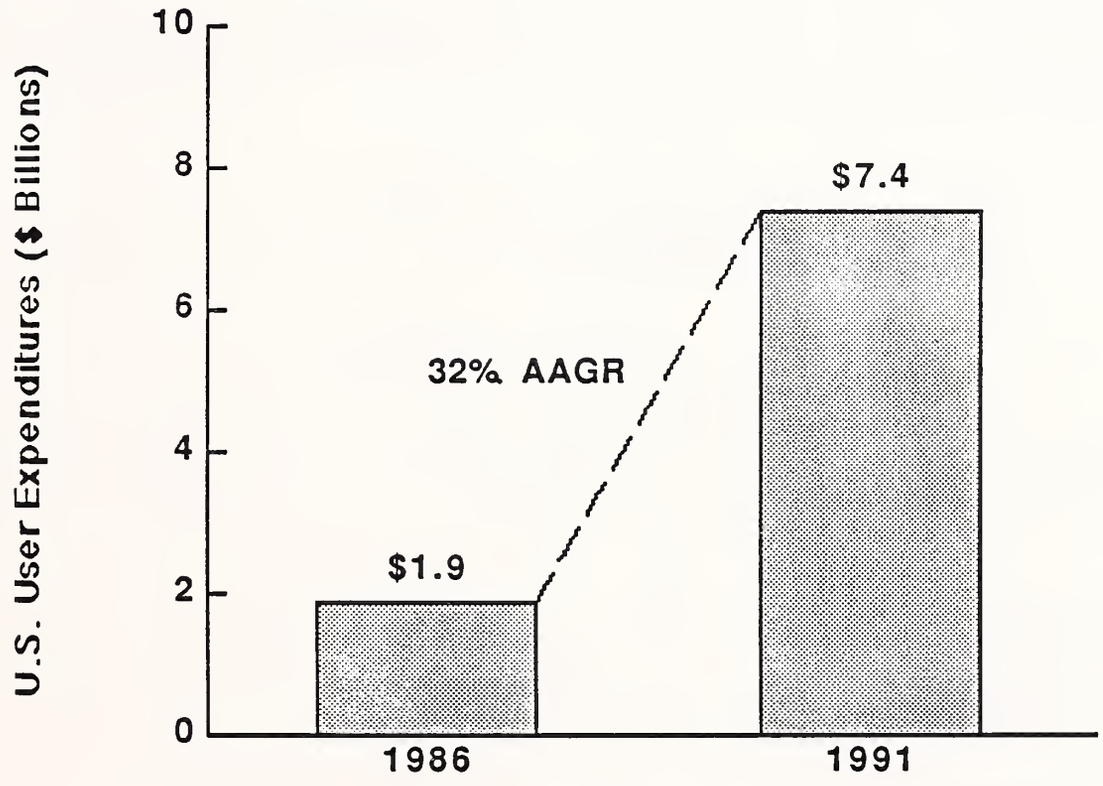
  - Competitive pressures on large businesses to improve management and control of their diverse, decentralized operations in order to better respond to domestic and foreign competition. In many cases this means increased automation at lower levels within an organization.

  - Willingness of PC-confident end users to expand their individual computer usage to the next logical level of automation--the department.

  - Attractive price/performance computing resource alternatives that combine low cost/high power/low environmental demands with ease of use.

INPUT®

FORTUNE 1000 DEPARTMENTAL SOFTWARE PRODUCTS TO EXCEED $7 BILLION



MSP3Jz

D. DEPARTMENTAL SYSTEMS ARE NATURAL GATEWAYS

- The computing environment of the future is a three-tiered (corporate, departmental, personal) series of hardware and software resources which will become extensively interconnected, as illustrated in Exhibit II-4. To be fully productive, users must be able to easily migrate across the boundaries of these tiers as the information needs arise.

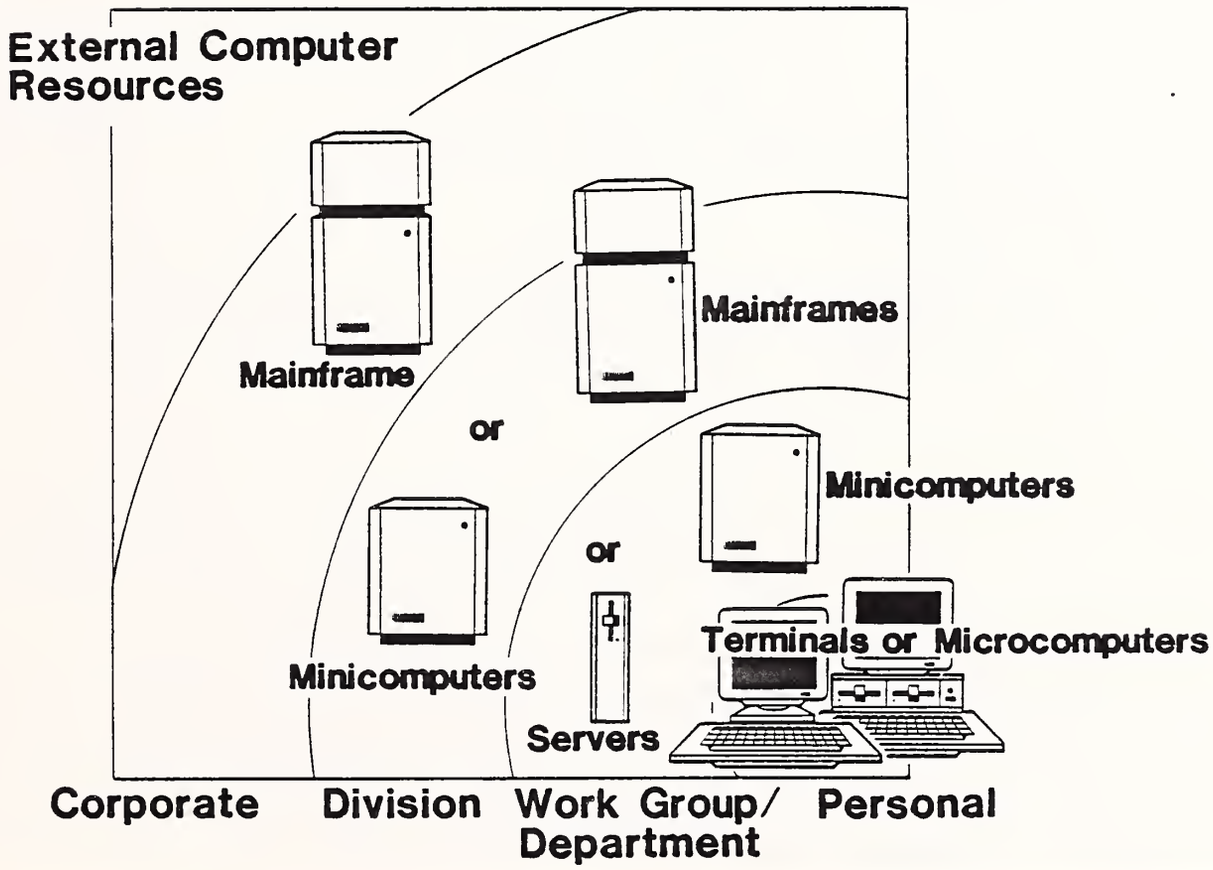
- In contrast to distributed processing attempts of the 1970s that withered, departmental systems of today are uniquely positioned to serve as excellent gateways to other departmental or corporate systems. Reasons for this recently obtained capability include:

  - Increased operating systems sophistication that facilitates inquiry and file uploading and downloading while still serving local processing requirements.

  - Enhanced speed that meets the users' requirements for subsecond response time in spite of the departmental systems role within a larger, highly complex system.

- Departmental systems derive their strength from being able to handle the complexities involved in intertier exchanges while remaining close enough, and responsive enough, to the individual user to be an excellent central source of computing power.

DEPARTMENTAL SYSTEMS ARE NATURAL GATEWAYS



E. THE NETWORK WILL BECOME THE SYSTEM

- Within the next decade, most organizations will discover that the concept of a "hierarchy" of computing is no longer useful. The balance of power between corporate and departmental nodes will shift. As interconnected departmental nodes increase in power and scope, the corporate "host" will shrink in significance to become primarily another node on the network, as illustrated in Exhibit II-5. It will no longer be necessary to go through the host in order to access and interact with other nodes. The corporate computer will become for the most part a data base server and network overseer.

- The concept of the real system being a networked group of equally accessible processors has numerous ramifications for both users and vendors.

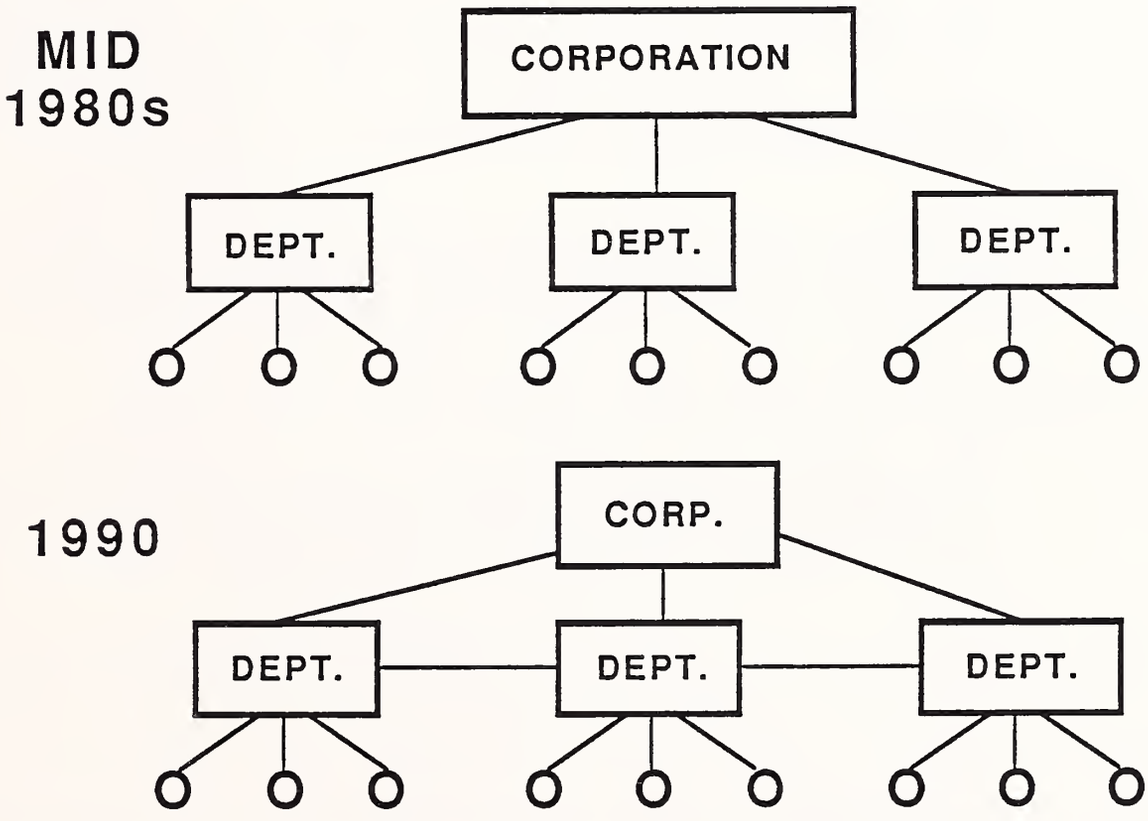
  - With the network as the system, the user potentially becomes more productive because of ease of access to whichever network resource is most appropriate to the needs of the moment.

  - More communications-trained data processing management will be required at the corporate level in order to handle the complexities inherent in a networked system with powerful nodes.

  - Applications development becomes more difficult because both functions and data can reside at numerous locations. New vendor offerings will help users address this problem, but will not entirely remove the pain and challenge.

  - Effective methods for tracking the location and accessibility of data and processing resources within the complex network environment will become essential, along with security techniques for protecting its integrity.

THE NETWORK WILL BECOME THE SYSTEM



F. USER RECOMMENDATIONS

- Departmental systems are a major opportunity. The reality of user needs, combined with impressive vendor offerings result in INPUT's recommendation to information systems decision makers to aggressively commit themselves to a departmental systems strategy within the context of a larger, organization-wide automation strategy. To be successful in the departmental systems arena INPUT recommends the following (as summarized in Exhibit II-6):

  - Insist that corporate level strategic business planning be thoughtfully integrated with information systems planning so that the organization translates automation investment into profitable marketplace differentiation.

  - Assure that the information systems organization is actively involved in all major departmental systems evaluations and decisions, while maintaining close interaction with the end users.

  - Seek solutions that interface well with a multivendor world. Proprietary architectures should be downplayed. Open-ended designs should be encouraged to facilitate user flexibility.

  - Seek well-defined application areas. The interconnectiveness of departmental systems adds a major layer of complexity in terms of system design, installation, and support. The success of the user's entire system could be threatened if a single component fails to work.

  - Emphasize customer education, training, and ongoing support. The end user faces major challenges with departmental systems. These challenges are not only technical, but economic, organizational, and political.

INPUT®

USER RECOMMENDATIONS

- Departmental Systems Are a Major Opportunity
- Keys to Success:
  - Aggressively Commit to a Deparmental Systems Strategy
  - Insist Corporate Planning Integrates Information Systems Planning
  - Ensure I.S. Involvement in Departmental Decisions
  - Interface Well with the Multivendor World
  - Seek Well-Defined Application Areas
  - Emphasize Support

III USER NEEDS AND EXPERIENCES

III USER NEEDS AND EXPERIENCES

- User needs are a continually changing mixture of perceptions, technology, psychology, economics, and politics. Several of the more important aspects of user needs are discussed in this chapter. They are:

  - Environmental framework of computing in the late 1980s.
  - Rate of acceptance of automated solutions.
  - Decision processes employed in system/vendor selection.
  - Application interest areas.

A. ENVIRONMENTAL FRAMEWORK

- There are a number of factors in the computing environment which significantly impact both the scope and the direction of departmental software. These factors include the services of white collar nonadministrative personnel, the corporate departmental personal processing hierarchies, the issue of connectivity, gateways to additional computing, and the proliferation of hardware/software options. These factors are discussed in more detail below.

1. WHITE COLLAR NONADMINISTRATIVE SALARIES

- Whereas early computing systems, such as payroll and accounts receivable, made a large number of administrative and clerical people more productive, the systems of the future will focus on that portion of the labor force which performs the most complex functions and which accounts for the largest labor cost--nonadministrative personnel. Their payroll costs 80% of the entire office labor expense (see Exhibit III-1). These people are rapidly becoming computer literate and thus are increasingly willing to embrace automated assists to their tasks.

2. THREE TIERS OF SYSTEMS NEEDS

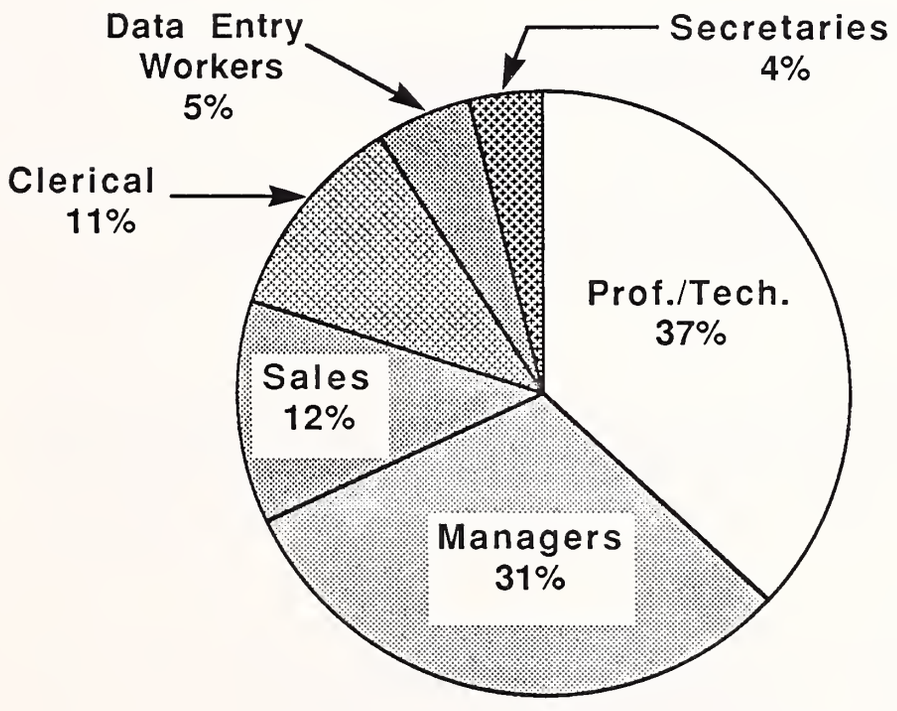
- As computing has become not just an optional but a potentially essential productivity tool of an organization, it is now reaching deeply into practically every organizational process of today's modern organization. However, because not all types of computing are created equal, systems have naturally evolved into different categories according to their hardware, software, economic, and organizational requirements.

- INPUT believes there exist three natural tiers of computing--corporate, departmental, and personal. Each of these tiers has its own important distinguishing features (see Exhibit III-2) which are important to understand in order to clarify user needs as well as forecast likely vendor directions.

  - Corporate computing--historically this has been the primary data processing activity within an organization. Usually residing at corporate headquarters with mainframe-sized hardware, this computing activity is increasingly characterized by large volume, transaction-oriented processing, much of which is batch. Corporate systems extend across multiple departments and are sufficiently large in volume to require computing resources beyond the scope of a single department.

EXHIBIT III-1

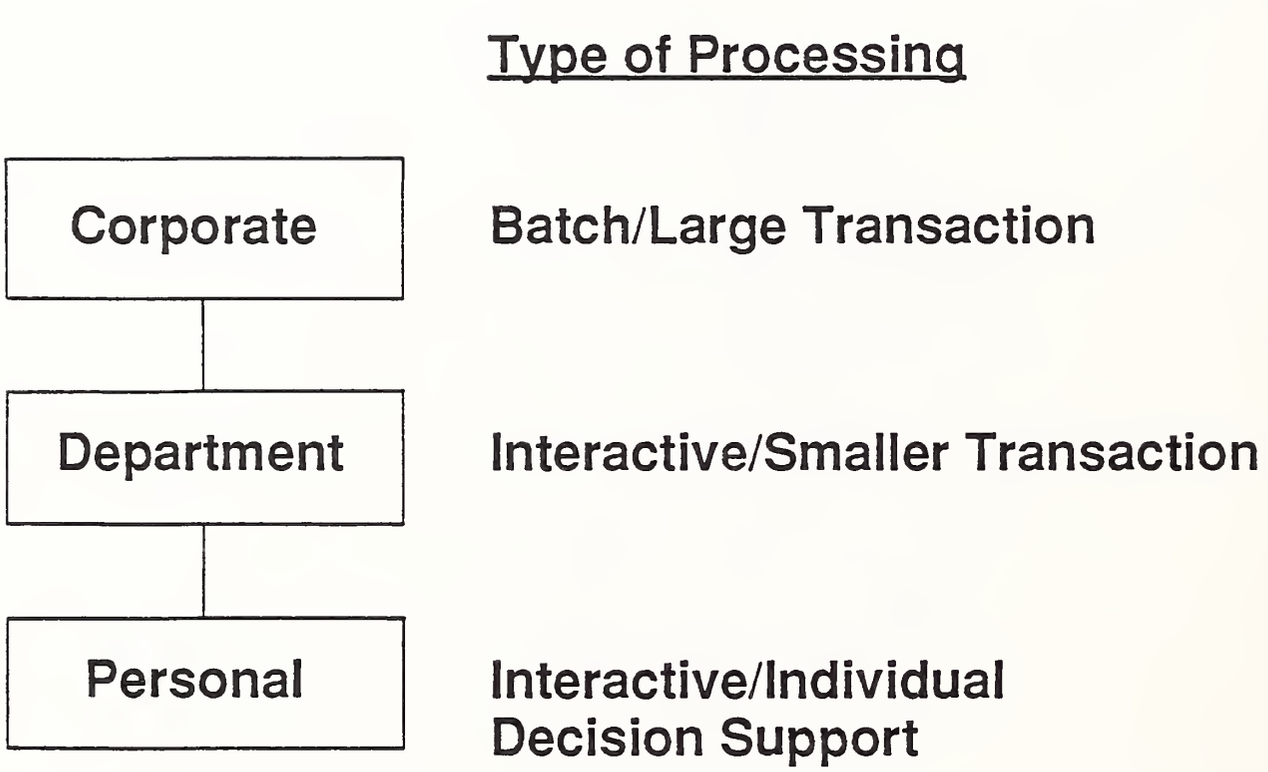
WHITE COLLAR SALARY PROFILE
($ Billions)



Total: $1,200 Billion

EXHIBIT III-2

THREE TIERS OF SYSTEM NEED



- Department computing--designed to address the needs of one or more work groups which share a common task, this type of computing typically involves a good deal of interactive processing as well as smaller-scale transaction processing. Information processed at the departmental computing level is usually shared primarily within the department. An application example is a data base update and inquiry activity for a shareholder accounting system for the trust department of a bank. (For additional discussion of departmental computing, see Sections I.B. and II.A.)

- Personal computing--this automation activity primarily supports a single person with applications requiring little or no sharing of information. Hardware used is most often a single-user personal computer.

3. THE IMPORTANCE OF CONNECTIVITY

- Until recently, the computing evolution within most organizations resulted in each of these three tiers becoming separate entities, with little foresight concerning cost-effective ways of exchanging software, hardware, or data between tiers.

- The single most significant development in computing during the next five years wil be connectivity, the manner by which these three tiers are electronically linked to facilitate easy access and exchange of information.

- The "urge to connect" is so strong that vendors as well as users who develop systems without current or easy-to-upgrade future connectivity capabilities have a very high risk of failure.

4. PLANNING FOR APPLICATION RESIDENCY

- When evaluating systems strategies, it is important to distinguish between those applications which reside on a certain type of processor for capacity or

political reasons and those which are so placed because of their computing characteristics. It is the latter reason which should be the driving force for long-term cost and user effectiveness.

- In order to develop successful automated systems for the balance of the 1980s, it is important to define a computing environment that matches the natural home (tier) for a given application.

- An application has several important parameters that help determine what computing tier it best fits. These parameters are:

  - Extent of data base sharing.

  - Volume of processing.

  - Volume of interactivity.

  - Processing capacity/availability.

- Exhibit III-3 shows five application interaction levels that should be considered. Each of these levels defines the degree of interactivity that must take place between the computer user(s).

  - Type A1, True Corporate Systems--these systems support a corporate-unique activity, such as consolidation accounting. The user resides at a corporate headquarters level, although the information is derived from multiple departments.

  - Type A2, Interdepartmental Systems--these systems support midlevel users from more than one department and require information from a variety of departmental sources. Computer integrated manufacturing, with its requirements for engineering, inventory, production, marketing, and accounting department input as well as output, is a prime example.

EXHIBIT III-3

USER INTERACTION LEVELS

TIER	TYPE ID	LEVEL NAME	APPLICATION EXAMPLES
Corporate	A1	True Corporate	Corporate Consolidation Accounting
	A2	True Interdepartmental	Computer Integrated Manufacturing (CIM)
Departmental	B1	Separate Department	Sales/Marketing Application
	B2	Shared Departments	Information Center
Personal	C	Individual	Word Processing

- Type B1, Separate Department--these applications serve one department only and require a minimum of input/output from other organizations. An example is a benefit administration system for a human resource department.

- Type B2, Shared Between Departments--multiple departments may be sharing a single resource, but no interaction occurs between those doing the sharing. For example, numerous departments may share an information center resource, but they do not exchange data. This is not departmental computing; it is usually just an economic-driven strategy that allows multiple independent departments to share a common hardware and software resource.

- Type C, Individual--no interaction between people is involved in this case. One person simply interacts with his or her chosen hardware and software, creating and using applications with no thought of sharing.

5. PROLIFERATION OF OPTIONS

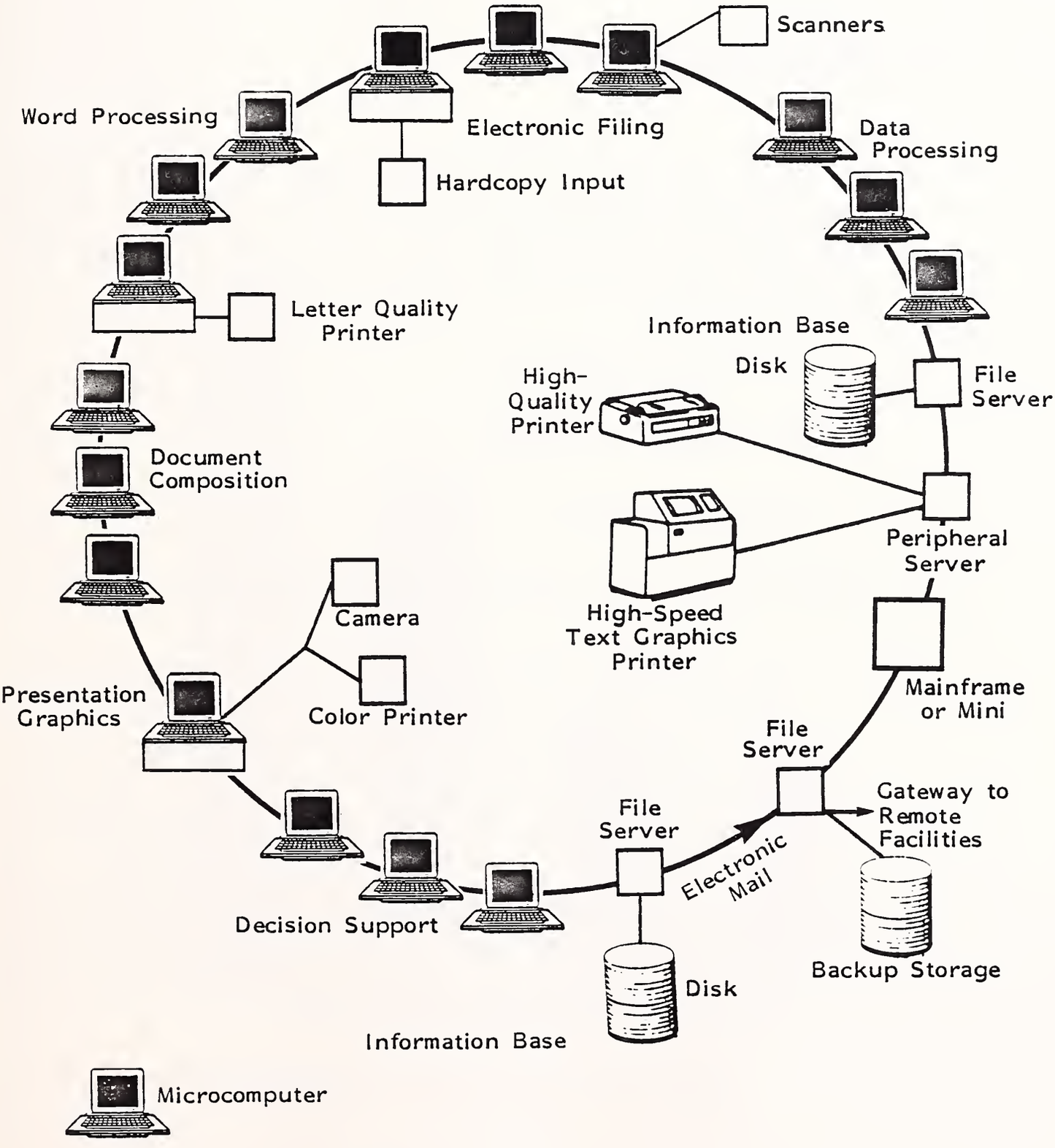
- The abundance of alternatives available to people requiring automation is both a stimulus and an inhibitor to departmental software growth. Exhibit III-4 illustrates just a small portion of the wide variety of processors, peripherals, and functions available in a single office network.

  - These options act as a stimulus whenever they serve to bring the users' needs in closer concert with the automated systems' capabilities. These sophisticated alternatives help users solve more complex problems that promise a higher organizational payoff.

  - Conversely, the rate of conversion to these automated systems can be slowed simply because of the numerous options which slow the evaluation cycle as well as raise the cost of the solution.

EXHIBIT III-4

PROLIFERATION OF OPTIONS
THE OFFICE PRODUCTIVITY NETWORK



- As can be seen from the foregoing discussion, the interaction of multiple types of users, systems, and vendors' solutions produces a complex and challenging planning assignment. Readers wishing a more detailed analysis of these important considerations are referred to Appendix B.

B. MOST ADVANCED DEPARTMENTS

- Within every organization some departments tend to become more advanced than others in the automation tools they embrace. When asked why some departments are more automated than others within their organization, respondents to INPUT's survey most frequently mentioned:

  - Management receptiveness.

  - Prior automation experience.

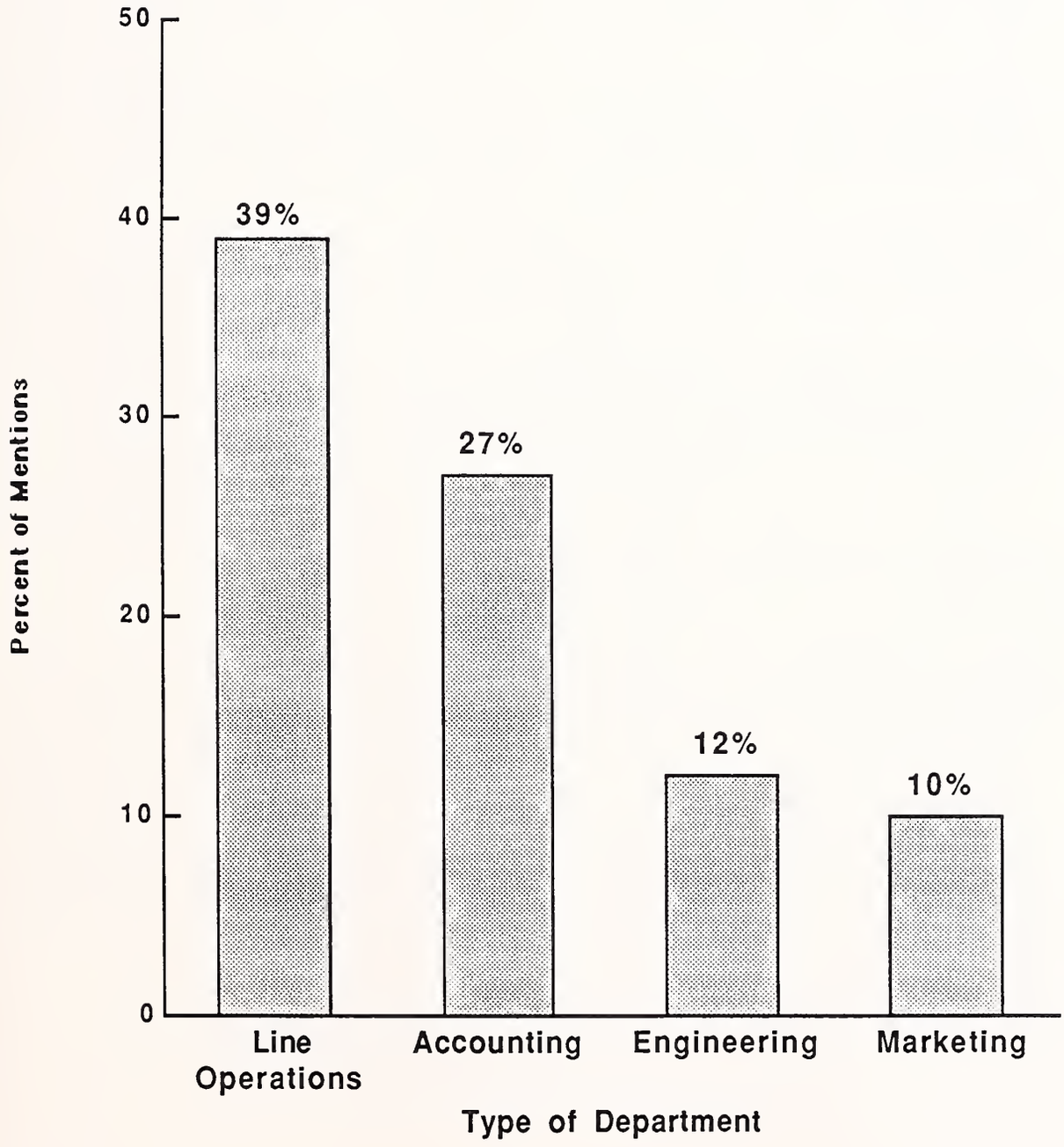
  - Competitive pressure.

- Exhibit III-5 shows the four leading users of departmental systems.

  - "Line Operations" ranked number one as the most advanced users of departmental systems across all industries. (A line operation is a departmental function that is a primary producer of revenue for the entire organization. Thus, a bank's line operation would include checking account processing; a manufacturing company's line operation would include the manufacturing operations.) Because of the criticality of line operations to accomplishment of the organization's mission, these units were often the first to be "granted permission" to divert from using centralized corporate data centers that were unable to respond to special needs in a timely fashion.

EXHIBIT III-5

MOST ADVANCED DEPARTMENTAL SYSTEMS USAGE*



*Remaining 12% includes information systems, legal, research.

- Accounting was the second most frequently mentioned department. Since these departments were frequently one of the first to automate in the early days of computing, they have a familiarity with automation that provides them with confidence to venture out beyond the security of the corporate data center.

- Engineering has become highly advanced in departmental computing, especially in many manufacturing organizations. Much of their automation sophistication can be traced to their long standing experience with specialized systems and workstations that have been evolving for years independent of the large, administratively-oriented, corporate computer centers.

- The marketing department is a distant fourth in advanced usage of departmental systems. Although sales and marketing systems have historically tended to lag behind other application areas in many firms, those that have adopted impressive computing solutions have often had to do so on their own. Having found little support from centralized data processing centers that have neither the time nor the department-specific knowledgeable resources needed to adequately support them, they chose instead to install departmental processors with specific applications.

- These line departments vary, of course, by industry. INPUT's research, however, revealed that the most advanced departments vary considerably by industry and by type of company. Thus, vendors must be cautious in porting relatively unchanged automated solutions across industries. Careful research is needed in advance to flush out differences between the same department within different market segments so that market strategies may be adjusted accordingly.

C. DECISION METHODS

1. DECISION CRITERIA

- When asked to rank numerous decision criteria for selecting departmental systems, respondents underscored the importance of having a high comfort level with the systems selected. Three of the four top-ranked criteria dealt with reliability, service and support, and ease of use (see Exhibit III-6).

- The rankings categorized themselves into three discernible tiers with the first four criteria making up the first tier. The second tier begins where there is a major discontinuity in rankings between the fourth criterion, which was rated a 4.3, and the next four rankings, which started with a 3.6. The third tier is the eighth ranked criterion, connectivity to other departmental systems.

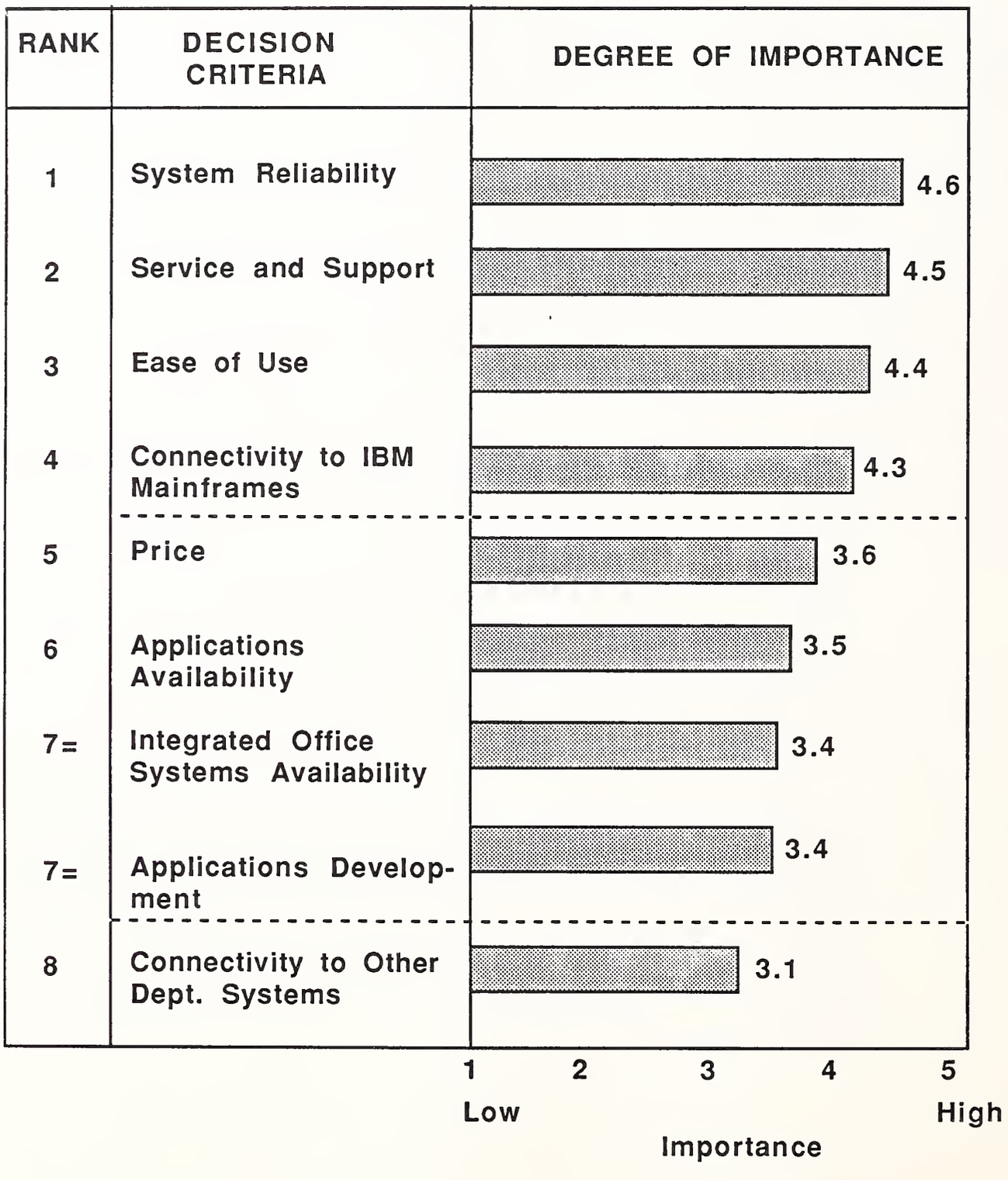
- Connectivity "upwards" (to the IBM mainframe) was a major consideration as it was rated a 4.3. Connectivity "sideways" (to other departmental systems) was considered to be of secondary importance.

  - This disparity reflects the market's newness to the connectivity issue and its conditioning to look to the host for resolution of resource requirements. Not surprisingly, the more advanced users rated the departmental connectivity criteria more highly than did less advanced firms.

  - In the long term, in INPUT's judgement, connections between a local departmental system and other accessible alternatives, such as neighboring multiuser systems and/or LANs, will be essential to the productive functioning of an effective computing solution. In this regard advanced users see the future more clearly than do the less advanced respondents.

EXHIBIT III-6

DECISION CRITERIA RANKINGS



- Interestingly, "price" scored higher (50) in importance among departmental system users than is usually found with those evaluating mainframe-based solutions (where it is typically ranked eighth or ninth). The higher concern with price among departmental system users of all types reflects, in many cases, their relative inexperience (as compared to mainframe users) with the full cost and impact of automated systems at this middle level. It also reflects the budgetary restrictions placed on lower levels.

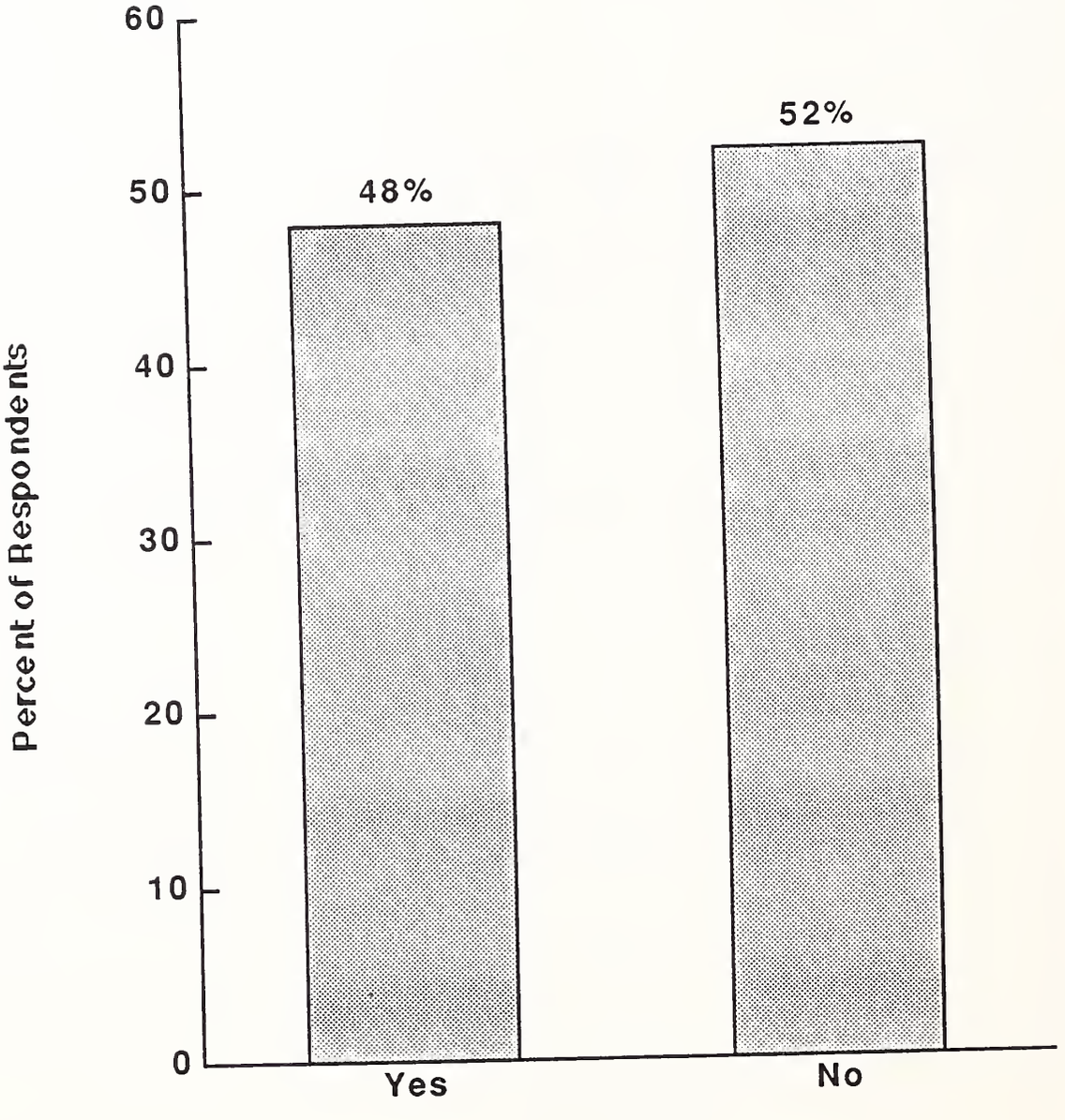
- For the most part there were few differences between the rankings of advanced and less advanced users of departmental systems. The one exception was integrated office systems (IOS) availability. Advanced users rated it as the least important of the criteria listed (although the average rating was still 3.2, indicating some importance is attached to its availability), whereas the less advanced users gave IOS a 3.7, resulting in a ranking of fifth. Many users view IOS as a set of "beginner" applications. Advanced users are most likely to have already had these needs satisfied via other means and thus are less concerned about its availability on the next departmental system they obtain. In addition, in some cases advanced users are looking more for applications development tools.

2. PRODUCTIVITY STUDIES

- The use of productivity studies to assess the impact of departmental systems is by no means a widespread phenomenon, as can be seen in Exhibit III-7. More than one-half of the respondents could recall no such study within the past 12 months. In addition, of the 48% who indicated they had completed such an analysis, very few could cite any specific results that were compelling enough to have resulted in any discernable action by management. INPUT believes that departmental systems have been and will continue to be justified primarily by intangible benefits which are very difficult to quantify before or after the fact.

EXHIBIT III-7

PRODUCTIVITY ANALYSIS UNDERTAKEN



D. APPLICATIONS ANALYSIS

1. NATURAL APPLICATION LOCATIONS

- As discussed above, astute users attempt to allocate applications to that computing tier (corporate, departmental, or personal) that best fits the user's needs in terms of application requirements and characteristics. Over the next several years, INPUT believes that certain types of applications will tend to gravitate to specific tiers. Exhibit III-8 summarizes the outcome of this migration.

  - Corporate level applications will be characterized by large volume systems requiring resources not justifiable on smaller computers (e.g., large, integrated, production applications) and/or systems requiring sharing among many departments (e.g., very large data bases with multiple department inquiry).

  - Departmental level systems are primarily shared among users from the same department (e.g., departmental data base, electronic filing).

  - Personal level applications support a single individual and must be highly responsive to that person's demands (e.g., word processing and spreadsheet analysis).

2. CHANGES IN COMPUTING CAPABILITIES

- When users were asked to rate the growth in importance of numerous computing capabilities accessible via telecommunications during the next two years, the three highest growth areas were departmental computing-related: integrated office systems, electronic mail, and micro-mainframe connections. As shown in Exhibit III-9, respondents predict a more than 50% increase in importance for these capabilities during the next two years.

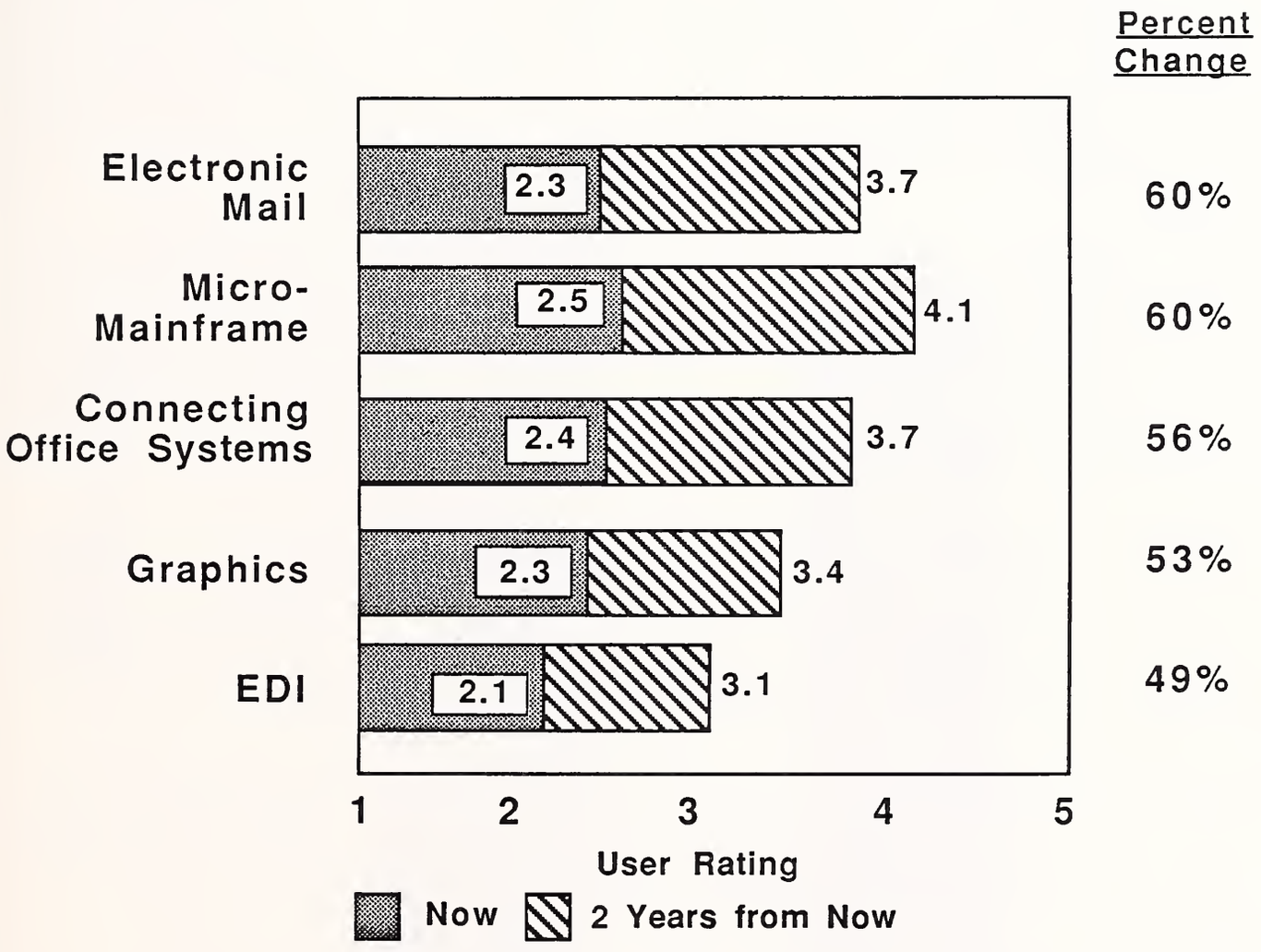
EXHIBIT III-8

NATURAL APPLICATION LEVELS

Level	Primary Functions
Corporate (Mostly Serving Entire Firm)	• Integrated Production Applications
	• Very Large Data Base
	• Information Center Support
	• Electronic Mail
	• Network Management
Department (Mostly Shared Within a Department)	• Document Processing
	• Electronic Filing
	• Electronic Mail
	• Departmental Data Base
	• Administrative Support
	• Departmental Transaction Processing
	• Occupation-Specific Applications
Personal (Mostly Individual Usage)	• Word Processing
	• Spreadsheet Analysis
	• Decision Support
	• Ad Hoc Reporting
	• Graphics Presentations

EXHIBIT III-9

CHANGES IN COMPUTING CAPABILITY IMPORTANCE



UIS3 S

- The following sections will discuss these areas in more detail.

3. INTEGRATED OFFICE SYSTEMS

a. Overview

- Users not only want their computers connected, they also have a strong preference for having their applications connected (i.e., integrated) within a given computer system. Exhibit III-10 shows that respondents rated both integrated applications in general as well as integrated office systems (IOS) in particular as having high importance.

- Integrated office systems are characterized as a set of heavily interconnected applications that address fundamental cross-industry documenting, filing, and communications needs of white collar personnel working in an office and requiring a medium to high degree of interactivity in terms of both written and/or spoken communication.

  - Typical functions addressed by IOS include word processing, spreadsheet, graphics, filing, E-mail, calendaring, data base, and calculator functions. More advanced IOS often include integrated voice/data functions, image processing, and bit mapped graphics.

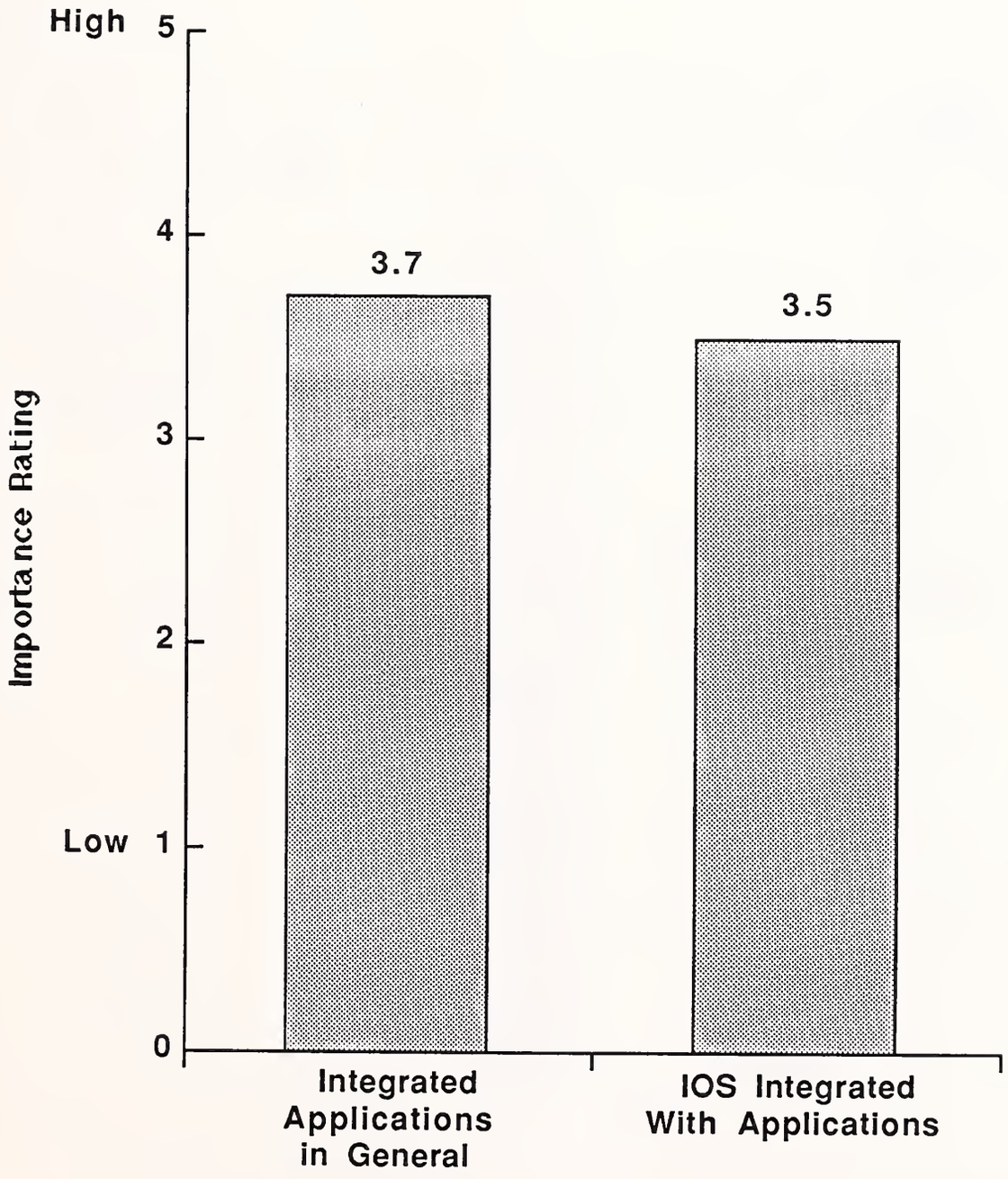
  - Examples of IOS software products are All-in-1 from DEC, CEO from Data General, DISOSS and PROFS from IBM, Personal Productivity from Hewlett-Packard, and WangOffice from Wang.

b. Forecast

- INPUT is bullish on the growth prospects of intergrated office system software. As shown in Exhibit III-11, annual user expenditures for all companies are forecasted to grow from a 1986 base of $133 million to $555

EXHIBIT III-10

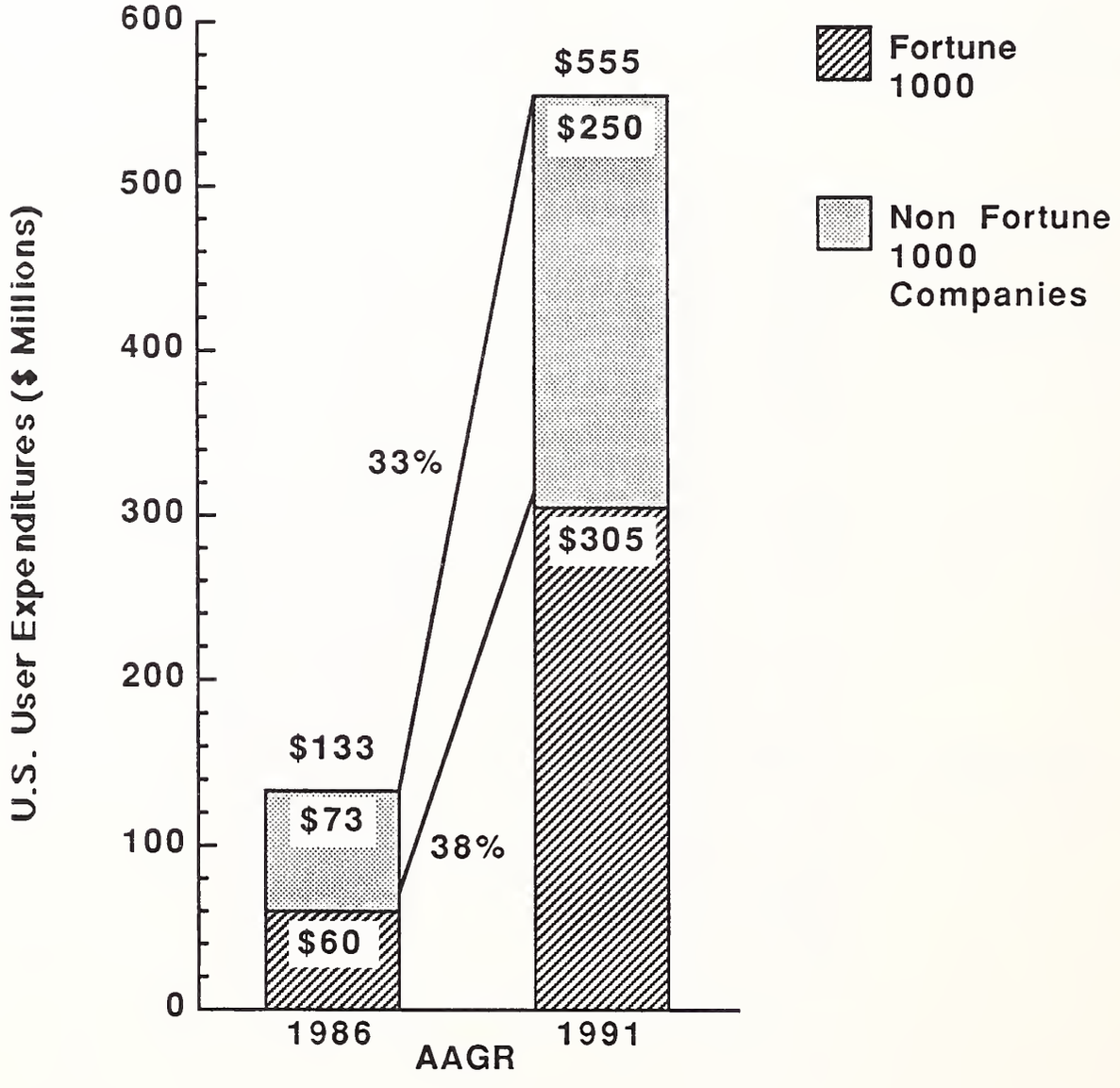
INTEGRATION IMPORTANCE



UIS3Jz

EXHIBIT III-11

INTEGRATED OFFICE SYSTEMS MARKET FORECAST, 1986-1991
(DEPARTMENTAL SYSTEMS)



million by 1991, a 33% average annual growth rate (AAGR). Fortune 1000 companies will experience a slightly higher 38% yearly growth rate, with expenditures rising from $60 million in 1986 to five times that amount ($305 million) by 1991. These growth rates are half again higher than the 24% AAGR forecasted by INPUT for all applications software products. Reasons for the impressive acceptance of IOS software during the next five years include:

- The universal appeal of applications that directly affect in a highly visible way practically the full range of office-based managers, professionals, and technicians as well as administrative support personnel.

- The quality of the design and implementation of many of the leading vendors' offerings. User satisfaction is high.

- The visibility of an installed base of thousands of systems.

- Emphasis on sales of the software by hardware vendors who have discovered that IOS can often sell midrange computers, just as VisiCalc software was the driving force that sold many Apple computers in the early days of PCs.

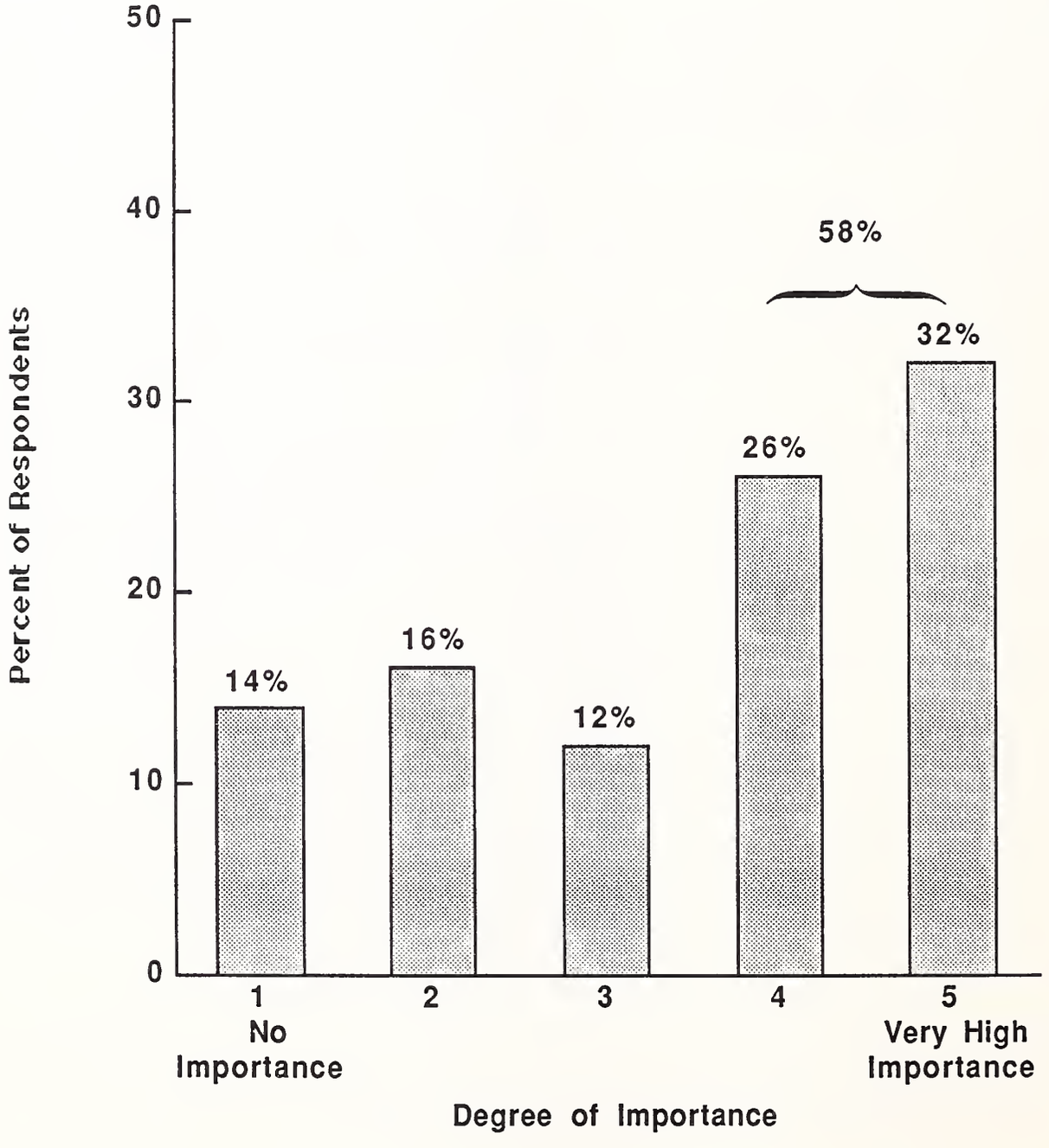
c. IOS Application Integration

- Users are now beginning to demand not only that office functions be combined into an IOS, but that the IOS itself be more effectively integrated with department-specific and industry-specific applications which are important to their group's overall productivity. Exhibit III-12 shows that 58% of the users surveyed rated such integration of high or very high importance.

- Some vendors are already beginning to respond to this need. DEC, for example, now offers special versions of its All-in-1 product tailored to the needs of marketing, human resources, and other specific departments.

EXHIBIT III-12

IMPORTANCE OF IOS INTEGRATION WITH APPLICATIONS



- Major opportunities exist for established applications vendors with department-specific (e.g., payroll, accounting, engineering) or industry-specific (e.g., manufacturing resources planning, point-of-sale, installment loan) offerings to enhance their value-added by offering IOS linkages appropriate to the needs of their targeted market segments.

4. ELECTRONIC MAIL

a. Overview

- Electronic mail (E-mail) is one of those rare applications that is at once a) simple to understand, b) powerful in operation, c) relatively nonthreatening to use, d) applicable to a wide base of diverse users, and e) requires connected systems in order to function. As a result, it is rapidly gaining a reputation as the single leading catalyst for bringing departmental systems into the mainstream of many office operations. Because of its relatively innocuous function, E-mail succeeds in breaking down the fear barrier of many people historically resistant to automation within their own office.

- While E-mail stimulates interest in all types of departmental systems, it is considered by many involved with local area networks to be the "Lotus of LANs." This is because it immediately brings to every PC user on the network a reason for using their workstation on a regular basis, irrespective of what other network applications, if any, may exist. A number of increasingly useful features are being added to many LAN-based E-mail systems. Examples include:

  - Voice store and forward. This allows mail to be stored at the file server to be read at a user's convenience.

  - Integration of text and graphics.

- Gateways for connecting to other in-house or external E-mail systems.

- File transfer capability for data and documents to/from specific applications.

- Message reading and responding without exiting from an application already in progress.

- Sharing of recalculable spreadsheets.

- Although no one E-mail system incorporates all these features as yet, many are actively heading in these directions.

b. Usage and Forecasts

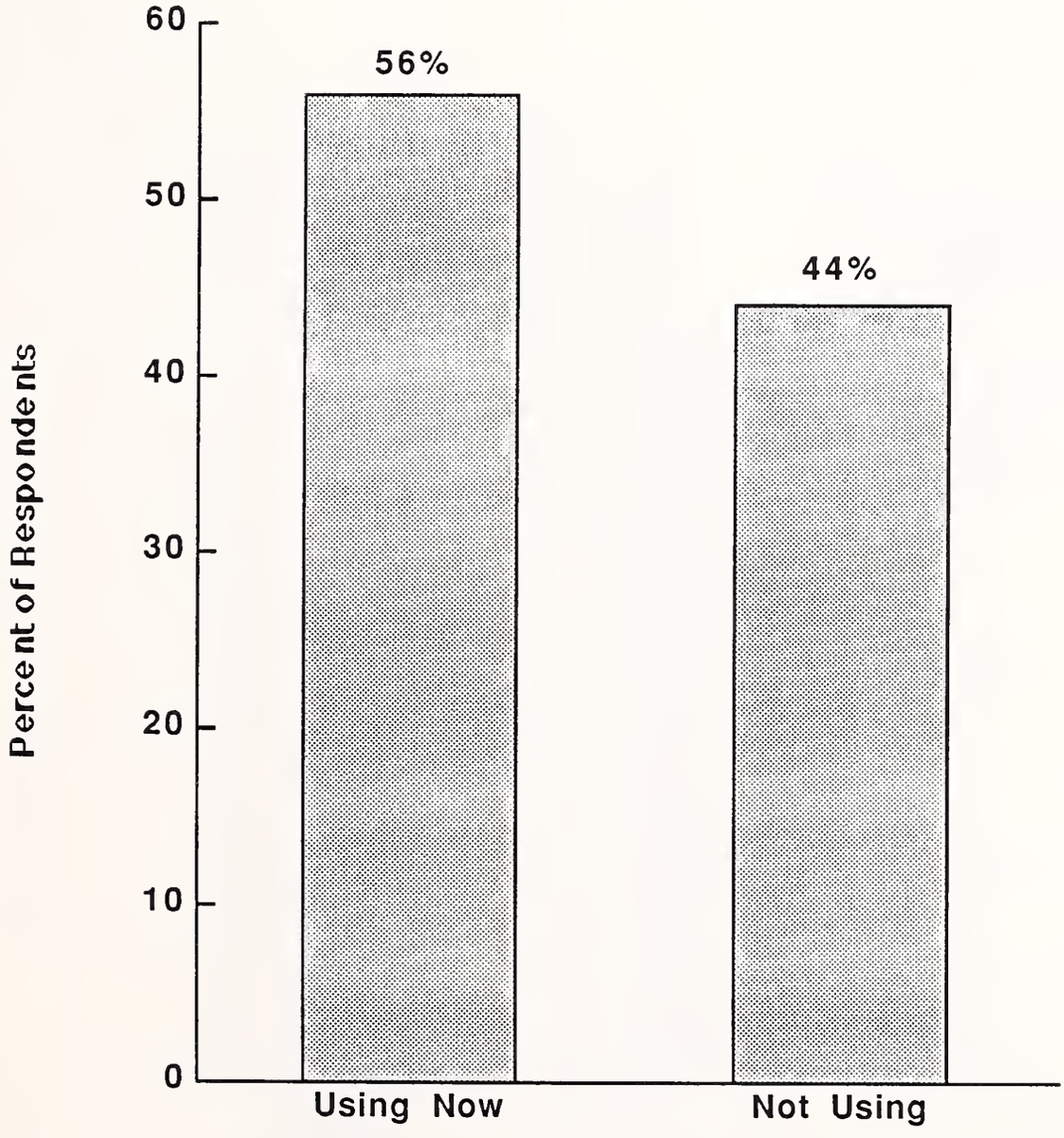
- Over one-half of the INPUT survey respondents reported using E-mail (see Exhibit III-13). Of those with E-mail operations, growth in the average number of users increased 89% (on the average) during the past year and is expected to increase by 115% in the next 24 months (see Exhibit III-14).

- INPUT forecasts that annual user expenditures for all E-mail software products (i.e., for all sized firms using both corporate and departmental systems, including E-mail embedded in integrated office systems such as PROFS) will grow from a base of $38 million in 1986 to $124 million in 1991, a healthy 27% annual growth rate (see Exhibit III-15). E-mail software products sold for use on departmental systems to Fortune 1000 firms comprise a little less than one-half of the total market, with expenditures rising from $16 million in 1986 to $57 million by 1991. Factors driving the E-mail software marketplace include:

  - The emerging popularity of local area networks which will rise from an installed base of over 68,000 units in 1986 to more than 340,000 units in 1991.

EXHIBIT III-13

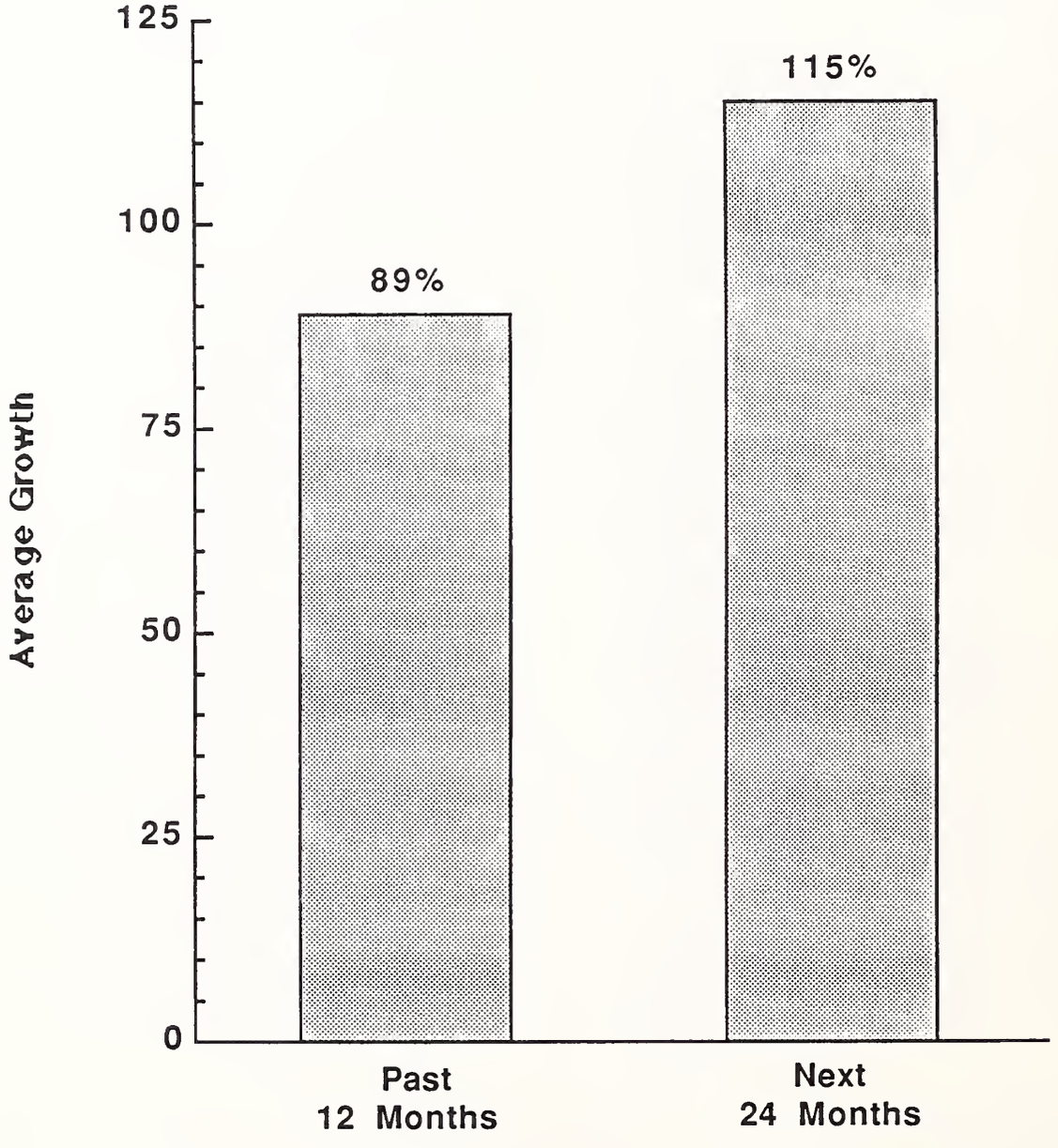
USE OF ELECTRONIC MAIL



UIS3Jz

EXHIBIT III-14

E-MAIL GROWTH AS REPORTED BY RESPONDENTS

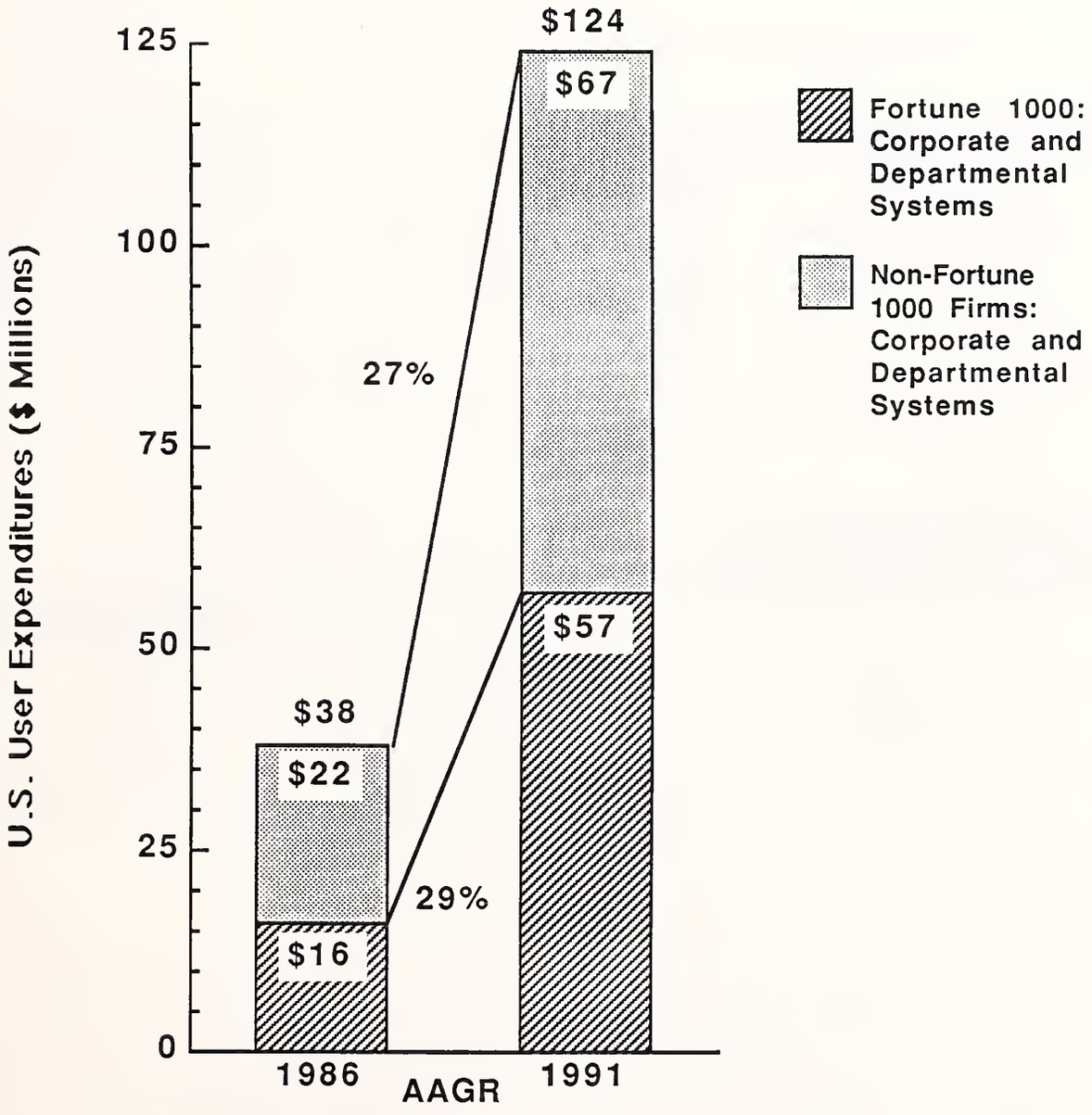


Growth in Number of Users

Average Number of E-Mail Users = 159

EXHIBIT III-15

ELECTRONIC MAIL SOFTWARE PRODUCTS MARKET FORECAST, 1986-1991



UIS3Jz

- The aforementioned multidimensional appeal of a simple application concept with power, broad-based applicability, and ease of use.

- Technology advances that will make possible the interfacing of independent E-mail systems (both internal and external) so that, like a national telephone system, users gain increasing payoffs as more users can be easily accessed.

5. MICRO-MAINFRAME CONNECTIONS

- Direct access to mainframes by personal computers (micro-mainframe links) has completed the initial phases of the typical new automation concept cycle faster than many prior concepts. Within the past three years, micro-mainframe links have rapidly gone from enthusiastic concept reception, to delayed/troublesome birth, and then to widespread enthusiasm at initial product introduction. The current stage, creeping disillusionment, reflects the limited functionality and awkward user interfaces of many initial offerings.

- In spite of earlier predictions, micro-mainframe connections will not decrease the load on the host computers. As shown in Exhibit III-16, these links will increase demand on both central processor as well as disk resources over the next several years. This is due to the processing complexity of the micro-mainframe functions and the lack of in-place operating systems and applications software specifically designed to handle the interactions as efficiently as needed.

- Exhibit III-17 indicates the nature of the micro-mainframe link evolution in terms of general capabilities. The real potential of these links lies in the future as this technology becomes more integrated with both operating systems and applications software and becomes more generalized in terms of types of software and hardware served.

EXHIBIT III-16

AVERAGE PROJECTED IMPACT OF MICRO-MAINFRAME APPLICATIONS

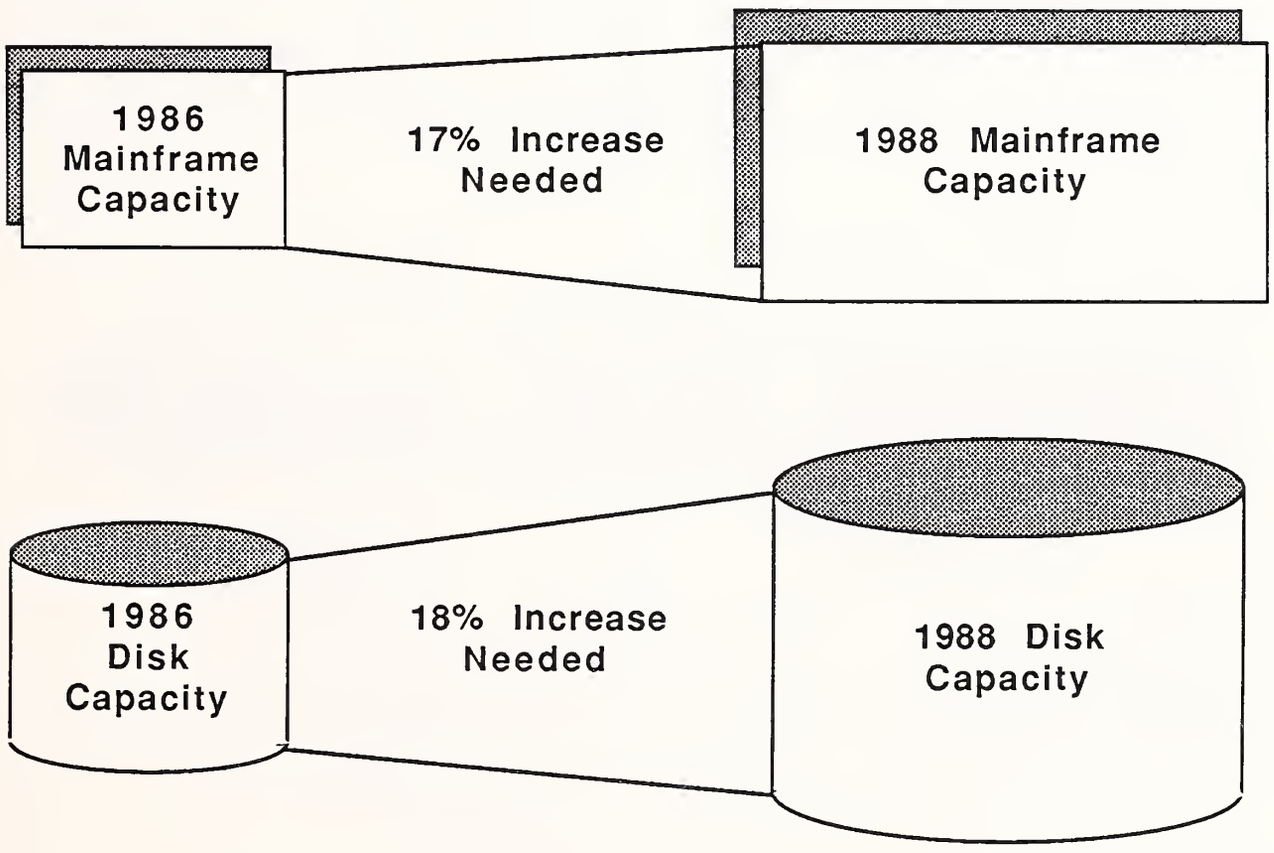
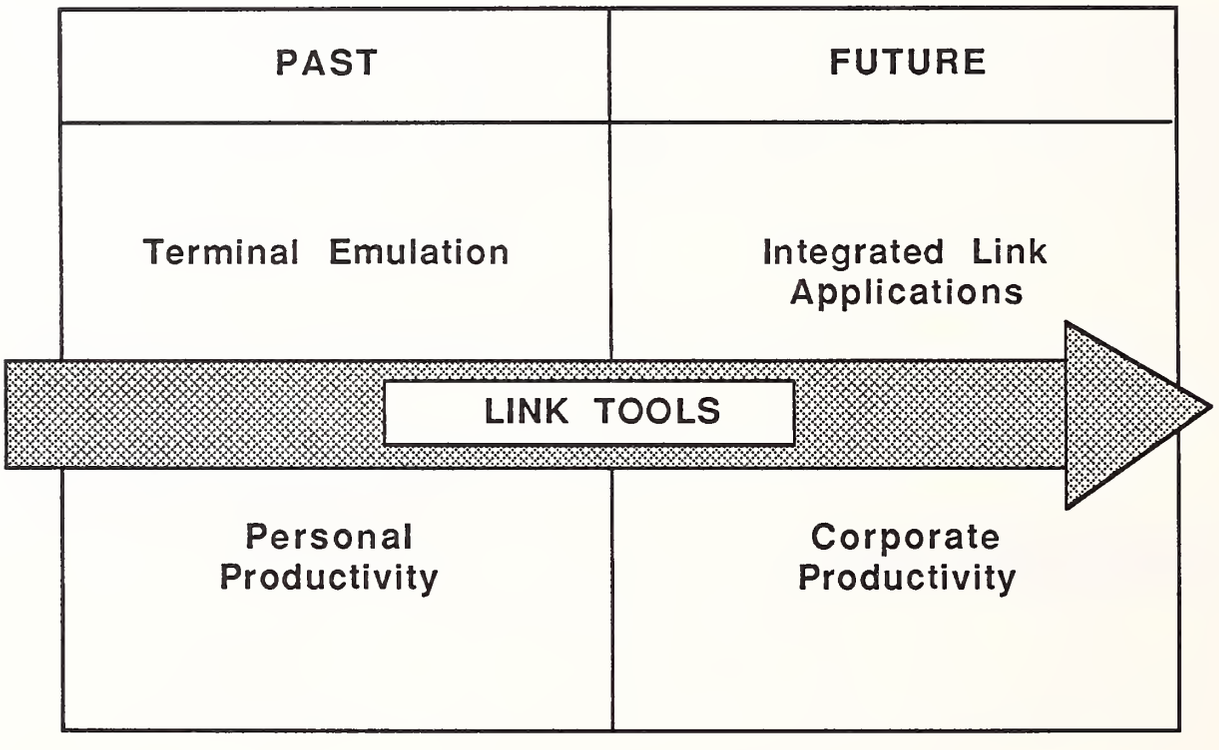


EXHIBIT III-17

MICRO-MAINFRAME CAPABILITIES IN TRANSITION



- In addition, the terminology itself will become increasingly obsolete. In the future many micros will be linked to midrange (i.e., departmental) systems as well as mainframes. Thus, the term "micro-anyframe" becomes more descriptive of the future.

E. CASE STUDIES

- When INPUT's research program for this year was being planned, it was decided to conduct in-depth, on-site interviews with a limited number of organizations and use them as "continuing case studies" as we proceed through this year's series of reports. The three organizations selected as case studies were as follows:

  - Case Study #1 is an organization which has elected to remain as close to IBM's systems software strategy as possible. This means they have adopted the highly centralized SNA approach to networking, have accepted a multiple operating systems environment (MVS/XA, VM, and TPF), and have adopted a dual DBMS approach (IMS and DB2).

  - Case Study #2 is an organization which has made major modifications to IBM's operating systems architecture and has developed its own data base management system, but is attempting to maintain a presence in 'both camps" between an IBM mainframe orientation and an equally strong (and uncontrolled) minicomputer environment.

  - Case Study #3 is an organization which has installed a network of IBM mainframes for "administrative" processing and minicomputers for "engineering" processing.

I. CASE STUDY #1

- Case study #1 is a large bank. For INPUT's operating systems study the vice president of technology support was interviewed, and the bank's strict adherence to IBM's recommended systems software strategies at the mainframe level was very specifically stated as being "true blue." Therefore, it is not surprising that the concept of the information center is also embraced and a substantial investment has been made in providing an environment for end-user computing. That environment can generally be described as follows:

  - It is large-scale, IBM-oriented, and operates primarily under VM/SP CMS.

  - Numerous enhancements have been made to permit data and file transfer between and among various hardware and software systems (a proprietary timesharing system under both CMS and ICF is provided) on the end-user network, including emerging departmental systems.

  - However, the extraction of corporate operating data from the MVS/XA environment (heavily IMS-oriented) to this end-user environment (heading toward DB2) has proved to be a bottleneck with batch runs and tape transfer between systems.

- For this study, the vice president of end-user computing was interviewed. He is responsible for internal and external timesharing services, personal computers, and office automation. The purpose of the end-user computing department is as follows:

  - To review hardware and software products for three operating environments.

    . Mainframe timesharing systems (as described below).

- Minicomputer systems (primarily Wang or IBM word processing systems).

- Microcomputer systems (Compaq PCs, various IBM PCs, Apple Macintosh 512s, and Wang PCs).

- To classify all reviewed products in one of four categories:

  - Standard "A" in which case the department actively markets the product to internal users and provides full support (acquisition and installation assistance, training, and documentation).

  - Standard "B" in which case the department provides acquisition assistance only if a Standard "A" product is not available (other support is not provided).

  - Not Recommended in which case no support is provided because a better product has been found (or it is found that the product does not satisfy user needs).

  - User Evaluation in which case no support is provided until the product has been evaluated.

- The obvious intent of end-user computing is both to provide assistance and to exercise control over the hardware/software selections of the end-user community. To give some indication of the magnitude of this undertaking, the first end-user computing "product catalog" contained over 100 "Standard A" products and a "Master Chart" of nearly 400 products which had been, or were being, evaluated.

  - The financial analysis and modeling products include six developed by the bank and ten commercial products (such as Lotus 1-2-3).

- The reference (proprietary) data base facilities supported by end-user computing include only one developed by the bank with the remainder acquired from government and financial service organizations.

- The data base management and information retrieval systems products include four developed by the bank and seven acquired from commercial sources (the "products" developed by the bank are primarily associated with enhancements to Nomad2).

- The supported graphics packages are all from outside sources and include those integrated with packages such as SAS and Lotus 1-2-3.

- The text and word processing packages are primarily Wang-oriented (12 of the 16), but two packages are fully supported for the IBM PC and compatibles (Multimate and Volkswriter).

- The office support systems at time of the publication were primarily those developed by the bank (an electronic mail system, personnel directory, and mailing list system), but this has changed significantly, as we shall see later.

- The two statistical analysis packages listed in the catalog were SAS (Statistical Analysis System) from SAS Institute and EMS (Econometric Management System) from Economic Sciences.

- In addition to the operating systems supported, the most prominent systems products and utilities reported were concerned primarily with file transfer (among the various mainframe, minicomputer, and microprocessor systems) and systems documentation packages.

- At time of publication (1985), the fully supported compilers and application development tools were MS Basic and Nomad (in other words, essentially PC or mainframe oriented--not "departmental").

- Cross-functional interfaces include a virtual network for transfering files across machines (and to output devices attached to those machines) and between Wang operating systems (OIS and VS) and the mainframe timesharing environment.

- Regardless of overlap of specific products in various categories (such as Lotus 1-2-3), the cost of supporting just the "Standard A" products is obviously substantial, and the additional cost of evaluating products is, in itself, awesome. For example, at the time of publication over 50 products were under evaluation, ranging from Displaywriter 3 to WangOffice and including PROFS, SYMPHONY, TIMM (The Intelligent Machine Model for building knowledge-based systems), and hardware such as the IBM Lap Portable and the PC AT.

- Most of the products listed in the product catalog could be classified as "departmental software" even though there are currently relatively few "departmental processors" installed (the bank having made a concerted attempt to stamp out minicomputers in line with its "true blue" operating systems orientation). These products are all designed to improve white collar productivity--from typists to loan officers managing multibillion dollar portfolios. The bank is currently expending more resources evaluating, installing, and supporting "solutions" for end users than most companies spend on problem analysis and implementation of the systems (both computer and paper based) necessary to run their organizations. The end-user computing department tends to focus attention on the end-user "revolution," and several conclusions can be reached from its experience.

  - The variety of "solutions" (products) available far exceeds the defined problems of the bank.

  - Even the most comprehensive office products address only a small portion of the white collar productivity problem and would more properly be classified as "tools" rather than "solutions."

- The availability of information processing tools immediately identifies the major missing ingredient in the "solution"--data.

- The ability to transfer data and files among various hardware/software products on the network (the bank has invested substantial resources in providing these facilities) soon reveals there is no assurance that the quality of information generated by the process will be sufficient to produce a measurable improvement in white collar productivity.

- Instead, it is felt that the quality of information could decrease substantially (despite rapidly increasing investment in hardware/software technology) if it were not for the end-user computing department. In other words, it is necessary to expend an enormous amount of effort merely evaluating and supporting the various "solutions" available in the marketplace if chaos is to be avoided.

- For those unable or unwilling to make the necessary expenditure to evaluate and support the use of end-user computing (as defined by the bank), the solutions have a disturbing tendency to become part of the problem. It is INPUT's opinion that this goes a long way toward explaining the continuing "slump" since it consumes resources that could otherwise be applied to new software and hardware applications.

- However, users are still looking for solutions, and the great majority of the products evaluated by end-user computing are initiated by users seeking products to solve specific business problems. The potential need for departmental processors manifested itself for the following reasons:

  - The highly centralized, large mainframe environment which appeared necessary (or at least desirable) in a terminal-oriented timesharing environment becomes something of a bottleneck for certain work units once computer power is distributed to the desktop. The problems

become quite obvious as floppies start being exchanged around the office and electronic mail betwen adjoining offices in Hong Kong gets routed through San Francisco.

- Work units with a high percentage of local transaction, common data requirements, and intraoffice communications sense the need and desirability for integration at the local level.

- Minicomputer and microprocessor vendors have traditionally sold to end users, and the classic struggle to wrest more control from the beleagured IS departments is being continually enhanced by both real and imagined shifts in costs across levels in the computer/communications network.

- Finally, and more to the point, tools permitting the relatively easy application of computer technology to business problems are becoming available.

- The end-user computing department was created in response to the demands of users for shifts in the distribution of processing power and data across the network hierarchy. The vice president of the department has a keen sense of the following:

  - The relative economics of hierarchical networks composed of mainframes, minicomputers, and intelligent workstations (as described by INPUT over the last ten years).

  - The potential danger of indiscriminately distributing processing power and data to the departmental level. (A major bank took a well documented plunge into distributed processing a few years ago with the result that little "information fiefdoms" developed. More time was spent on internal power struggles than on using information to improve institutional performance.)

- The considerations of data and information quality (data base integrity and synchronization, privacy and security, conflicting reports to management, etc.).

- Even with substantial knowledge, the complexity of the current technological environment, in terms of both installed hardware/software systems and current alternatives, presents the end-user computing department with a Herculean task.

- The bank is one of the largest users of IBM and Wang equipment in the world (Apple, too, for that matter). When confronted with the requirements for departmental processing about a year ago, the bank naturally turned to those vendors for solutions. (They looked at Data General's CEO and found it to be "excellent," but the investment in IBM PCs precluded serious considerations. DEC seems to have been ruled out because they were identified with early minicomputer experience in the bank.)

  - The System 36 was rejected as a departmental processor because it did not have a DBMS and IBM clearly stated there would be none. (Perhaps the recently announced linking of System 36 to System 38 is supposed to provide an eventual solution.)

  - Wang's strategy made considerably more sense to the bank, and product announcements, and enhancements since the time of the evaluation have tended to support that strategy. One of the main attractions of Wang was that the VS series had "lots of compatible growth" and was "rigorously migratable.")

- However, while the bank has an enormous investment in Wang equipment and is currently converting from OIS to VS, WangOffice has not become a "Standard A" product because there are other problems which customers are asking Wang to address.

- Service is deemed to be "poor," hardware/software releases need better coordination, and products should be modular.

- They believe that Wang does not understand data processing very well and that they still do not want to be "rigorously hardware/software compatible" with IBM ("like Compaq").

- Finally, the well publicized top management problems at Wang are the source of some concern to Wang customers.

- Therefore, while Wang may have won a "departmental processor" battle, the war at the departmental level is far from over. The bank is in the process of installing Token Ring LANs, and PROFS is being extensively used--to quote the vice president of end-user computing: "PROFS has a life of its own." In addition, the adoption of IBM's SNA and operating systems strategy at the corporate level inevitably filters down to the end-user computing department, and the need for minicomputers in the hierarchy is being seriously questioned "once the 80306 desktops become available."

- There is a significant statement in the bank's catalog description of the Wang VS 100 System Unit: "It requires site preparation and a systems administrator." During the interview the question was raised as to whether a data base administrator might not also be required if data base applications were distributed to the system, and the answer was "probably."

- It is doubtful that Wang will ever be more than an unwieldy word processing appendage to the mainstream data and information flow of the bank. This is true because the adoption of IBM's highly centralized operating systems strategy assures that "departmental processors" will be bypassed as applications and data are distributed over the network. In fact, this can be justified based upon problems of data base integrity with which the bank is all too familiar.

- INPUT's IBM's Operating Systems Strategies report described the current difficulty in transferring files between the MVS/XA (IMS) and VM/CMS (DB2) systems at the bank. Essentially, it is a batch operation with physical tape transfer. Since that report was written, the bank has found that the installation of a Teradata data base machine facilitates applications development, but IBM has not promised shared files between MVS/XA and VM applications until 1987. Therefore, the data base integrity and synchronization problems at Level I of the processing hierarchy (mainframe) continue.

- It is INPUT's opinion that IBM's preferred method of data base distribution will be through DB2, and even though the bank has made provision for the transfer of data among various systems connected to the network, another level of batch processing becomes involved when any substantial amounts of data are transferred between Level I and Level II (minicomputers). In addition, any rearrangement of data increases problems of synchronization and integrity (to say nothing of privacy and security). A good argument can be made that distribution to an intermediate level does not make sense in terms of both data quality and expense, and you can be sure that both the central IS department and IBM will make these points.

- Applications exists only where data are available, and whoever controls data will effectively control the information systems and the way an organization functions. Adoption of IBM's highly centralized software strategy is predicated on such control and all talk of connectivity and open systems architectures is relatively meaningless if data are controlled centrally. The peer with the data is always going to be "more equal" than the one without, and departmental processors fall into the later category when operating in a "true blue" IBM operating systems environment.

2. CASE STUDY #2

- Case Study #2 is a major university which was originally selected for interview because of extensive software development efforts in the area of IBM operating systems enhancements, DBMS development, and networking. For this study the director of administrative information services, who is also responsible for departmental information systems, was interviewed. This case study will concentrate on evaluation of office automation efforts, but first a brief overview of the general environment.

  - The university is on the leading edge of computer/communications technology and is currently installing an integrated voice-data network on campus.

  - Computer literacy is an active program among faculty and staff and "work at home" is encouraged over the public network.

  - Proprietary IBM operating systems enhancements are complemented by an advanced DBMS, electronic mail systems, a text processing system, and a graphics and printing system. (These services are actively promoted through the central information technology services department.)

  - These central services are IBM host oriented, but minicomputers (primarily DEC) are installed in many departments (frequently in connection with specific research projects or grants). As mentioned in the operating systems report, this has resulted in the central processors being viewed as a node on Ethernet. The manager of systems programming stated, "They try to keep a foot in both camps" by providing access to both DEC and SNA terminals.

  - However, the office automation effort on the campus has been placed under administrative information services which is essentially oriented

toward large-scale IBM mainframes. Due to the nature of the academic environment, very little effective control can be exercised over the selection of particular hardware/software products used by the various schools on the academic side of the university.

- Therefore, the acceptance and use of office automation products and services over the university's network hierarchy provides some insight into the proper role of departmental processors. Fortunately, departmental information systems had just completed a study of office automation on the campus, and while it was not designed to focus on departmental processors (but rather on micros and mainframe services), it does permit certain conclusions to be drawn.

- Over 1,000 staff members of the university received a survey on their use of office automation products and services and over 65% responded. Approximately 63% of the sample population came from academic schools of the unviersity and 37% from central administration. A simple statement of the methodology is as follows:

  - A list of nearly 50 administrative tasks (originating memos, preparing reports of various sizes, typing documents, budget preparation and tracking, scheduling, recordkeeping, editing, maintaining lists and directories, etc.) was presented to the respondents and they were asked which ones they used automation equipment (word processing equipment, personal computers, or terminals to larger systems) to perform.

  - They were also asked to estimate the amount of time they spent using automated equipment in the performance of these tasks and what types of equipment and services were used.

  - The responses were weighted "to simulate a population that approximates the characteristics of the true population," and thereby permit

comparisons across various work units and allow conclusions to be drawn about "typical" staff members. Based on this approach it is possible to make the following general statements:

. If you randomly selected an office on campus and met a randomly selected individual working there, the most likely probability is that 37% of the tasks the person performs will be done using some "means of automation."

. In addition, the "typical" staff member in the survey population spends 32% of his or her work time using an automated device, specifically dedicated word processors, microcomputers, or terminals connected to the mainframe or minicomputers.

- While clear statements concerning the distribution of tasks and time over the processing hierarchy were not made, it is possible to reach certain conclusions based on the following information which was presented.

  - During the last year, 57% of the tasks automated by the "typical" individual will have been done on a microcomputer or word processor, as opposed to 53% in 1984.

  - Eighteen percent (18%) will have been done on central mainframes, compared with 20% in 1984.

  - Twenty-four percent (24%) will have been done on minicomputers, compared with 27% in 1984.

  - The general conclusion which can be reached is that work (as represented by tasks automated) is being slowly transferred to microcomputers and word processors, and some of this work has been distributed from both mainframes and minicomputers (departmental processors).

- It was estimated that 81% of the population used some form of automation on some tasks, and there was naturally overlap among the use of equipment. For example:

  - Twenty-nine percent (29%) of the population used word processing equipment (primarily clerical personnel).

  - Thirty one percent (31%) used standalone microprocessors.

  - Forty-eight percent (48%) used terminals (or micros) connected to either mainframes or minicomputers.

  - The percentages of people stating they sometimes use such office automation equipment (108%) adds up to substantially more than the 81% of the total population because a considerable number use at least two modes of operation.

- The same type of overlap occurs when terminal users are asked whether they are connected to mainframes or other computers. For example, 31% stated they connected to the central data processing facility and 35% connected to "other." Obviously, this can be explained by the fact that a substantial portion of the terminal users (48% of the population) connected at various times to both the central facility and also to what can roughly be termed a "departmental processor." In fact, it is possible to conclude that, despite an all-out effort to attract users to the central facility, more users still connect to some form of local (or departmental) processor. This tends to support the fact that more tasks are being "automated" on distributed processors. INPUT finds this to be curious for several reasons:

  - Excellent central facilities have been provided from the IBM host for an extended period of time (the text processing system and data base system have been installed for over ten years, and the electronic mail system for nearly as long).

- Many of the minicomputers on campus have been installed for research projects in technical areas and not as office systems.

- The orientation of the office automation effort on campus is toward the central facility and micros, in terms of active promotion of the services and also in the assistance provided for systems development, installation, and training.

- It would appear that there is need, or desire, for intermediate processors between the desktop and the large central host. INPUT believes that this is a manifestation in support of a "proper" network hierarchy (for reasons which will be explained later).

- When asked the type of software which is being used, the results were not too surprising.

  - Seventy one percent (71%) of the respondents stated they used a word processing program (36% MultiMate, 30% Wordstar, and 10% the proprietary mainframe-based system). The central text processing system has many facilities not available in the micro-based systems, and it was available (and being promoted) before there was such a thing as a personal computer.

  - Forty-seven percent (47%) stated they used data base programs with the most popular being DataEase (34%) and with the proprietary mainframe system having 23%. Once again the mainframe DBMS has been around for a long time, has considerable functional capability, and has even been established as a standard for systems development on campus, but the micro-based systems are already beginning to prevail and several questions arise:

. How many of the mainframe DBMS users are information systems personnel (or are connected to systems developed by the central information systems area)?

. Why aren't any minicomputer DBMSs mentioned? (Because they don't exist? Have so little use? Or because the "standard" forced them under cover?)

- Forty-six (46%) stated they used "communications programs" which presumably includes access programs, EMS, and file transfer programs.

- Forty-three percent (43%) used spreadsheet programs with 77% using Lotus 1-2-3.

- The most heavily promoted service from the central host facility is the electronic mail service. It provides an informative "mini-case study."

  - Several years ago the promotional efforts included free one-year subscriptions to 100 management level personnel including the president of the university.

  - Eighty percent (80%) of those surveyed were familiar with the service. This made it the most well known service on campus.

  - However, only 35% of the respondents to this year's survey use the service.

    . Thirty-five percent (35%) of those who know about it state they "don't need it."

    . Ten percent (10%) say they "can't afford it."

- Those in the central IS function who use the service find it is of considerable benefit (reducing phone calls, speeding communications, scheduling meetings, etc.), but resistance remains. This is somewhat frustrating for those promoting office automation, and there has even been consideration given to providing the service "free, just like messenger service."

- However, ancillary research indicates there may be other reasons for this level of resistance:

  . First of all, the mainframe orientation of the service may actually make it too expensive for those departments with a high percentage of intradepartmental communications.

  . Second, there are indications that the volume of messages and documents exchanged electronically increases dramatically, and there are those who regard a lot of this as "junk mail" which would have to be disposed of in some fashion. So some users may not want to get exposed to it at all.

  . Finally, work units engaged in project work on minicomputers tend to use the facilities provided on their system for intra-project communications--in fact, if EMS services are not provided they invent their own.

- A clear winner among the centralized services was a graphics and printing system which was used by a somewhat astounding 46% of those surveyed. It is one of the most sophisticated systems which exists and probably will not be replaced with desktop publishing systems in the near future.

- The office automation study made several significant points, and one of the most important was that in analyzing benefits and costs it is necessary to proceed from the "individual level" to the "office level" and on to the "university level." The following points were made:

- Automation tools at the university level have a significant impact on the performance of work at both the individual and office level.

- When integration across the three levels exists, the results are "extremely beneficial."

- It was stated that "industry" usually concentrates on the office perspective with some attention given to productivity tools for the individual and that this view tended to centralize the data processing function without regard for extensive linkages to other levels.

- The report concluded that they were convinced that for office automation to be truly effective, it was important to build integrated systems which provided linkages across the levels.

- INPUT heartily endorses these conclusions--as far as they go. The three levels used by the university correspond to INPUT's three levels--corporate, departmental, and personal. However, the intent of the central IS function would seem to remain upon highly centralized systems (including a standard mainframe DBMS) which practically precludes the distribution of function to minicomputers. (It was stated during the interview that they did try to integrate DECs in some of their systems efforts "if they are under VMS," but really had not been too successful.) In other words, despite considerable enhancement to systems software and an effort to maintain a presence "in both camps," the fact remains that the IS function feels much more comfortable implementing systems on IBM mainframes, and departmental processors (minicomputers) are considered an unnecessary evil which hopefully can be wished away or manuevered around.

- There is little attention being given to what is going on on the installed base of minicomputers on campus even though there are indications that more "office automation" keyboards are normally being serviced from "other

computers" rather than from central IBM mainframes. This is where both the study and the conclusions reached did not go far enough--the cost-benefit analysis did not include hardware/software and INPUT does not believe that any analysis of productivity or performance can be complete without it. Without thorough analysis of relative hardware/software costs on an application-by-application basis, it is not possible to determine the relative merits of not only distributed versus centralized processing, but computerized versus manual systems.

3. CASE STUDY #3

- During the operating systems study, the director of corporte information services (CIS) of an international semiconductor company was interviewed. It was determined that there were three primary interconnected networks in the company.

  - An MVS/SNA network running on an IBM 3083J which connects terminals in eight buildings on the "campus" and at two remote locations. In addition, three 4341s (one in the United States and two in the Far East) are included in the network, with a link to a European MVS/SNA network.

  - A VM network is hosted on an IBM 3081G; it serves as the "end user" network and services various terminal clusters, workstations, home terminals, and campus LANs. It is connected to TymNet, DECNet, the MVS/SNA network, directly to the domestic 4341, and to the campus LANs (through Ethernet and a K200 gateway to the fiber optics backbone connecting the local LANs). In addition, the VM network serves as the primary link between the corporation's "administrative network" and the "engineering network." It has PROFS installed and provides FOCUS for the development of end-user systems.

- The DEC network uses the K200 gateway for a fiber optics connection with six campus buildings wired with DECNet and connecting 35 minicomputers located on campus. Using a LAN bridge, the net connects to other DECNet LANs and another 30 minicomputers in the United States, and, although through a MicroVax II, it connects with 3 minicomputers in the Far East.

- These networks require 20 pages of diagrams to depict them, and the director of CIS does not have much to say about "connectivity" beyond that. In fact, he seemed to prefer talking about integrated applications, which for him seemed to have more meaning because "it is one thing to connect and it is something else to integrate."

- As a practical example of this philosophy, he talked a little about computer integrated manufacturing systems (CIM). "The question has been raised as to whether we are talking about 'CIM' or 'cIMS,' and the answer is quite clear--it has to be the latter. We are concerned not only with computers but with the whole process--from the salesperson writing the order to the program on the chip. All that information moves now sometimes more slowly than we would like, and sometimes it can be too fast, sometimes it is on paper, and sometimes it is over a data network, sometimes that network is ours and sometimes it is public, sometimes the solutions are easy and sometimes they are hard, but there is one constant--you had better know what you are doing."

- As far as departmental systems are concerned, decisions are made on a department by department basis. "Sometimes it makes sense to put a processor out there and sometimes it doesn't." In order to point out the difficulty of generalizing about departmental processors, he used the example of the sales department in the United States (a work unit without geographic centralization). The following points were made:

  - They are considering a separate departmental processor because the system being considered has requirements which are not required by most other systems in the company.

- They would like to be able to broadcast voice messages as well as provide data base access.

- Mobile terminals connected through cellular radio are being considered for data base access and order entry.

- In other words, an on-line information center for both data and voice traffic is required specifically for the sales department, and the question becomes whether the system should have a separate node (processor) for this purpose. There is no one right answer to this question--a thorough analysis of many diverse factors such as product, organization, in-place networks and systems, economics, and company philosophy come in to play. It is doubtful that a group of generic applications would be considered a solution to this problem.

- Thus, the Case #3 network could include all levels of the network hierarchy. As pointed out so aptly by the Director of CIS, the challenge becomes one of systems integration, and it should be clearly understood that the systems which must be integrated include current paper-based systems as well. This integration will take two forms:

  - The redistribution of existing processing and data bases to more appropriate levels in the network hierarchy based upon complex considerations of the type mentioned when discussing the sales department. It has long been IBM's strategy to maintain highly centralized control from IBM mainframes, and the strategy of other vendors to offload those mainframes. Considering the underlying economics of distributed processing, IBM has been remarkably effective in imposing its SNA strategy (as illustrated in Case Study #1).

  - The elimination of current paper-based systems through integration into the computer/communication network. It is not an over-simplifi-

cation to say that all of the concern about departmental processing is created by IBM's desire (and design) to see that such paper-based systems are integrated at corporate and personal levels, and the conflicting strategy of competitors to see that those systems are integrated at the departmental level. This area is critical because the replacement of existing paper-based systems is the obvious growth area for the computer industry for the 1990s.

- To a certain degree, even Case Study #3 demonstrates a considerable amount of IBM control over the area of departmental processing. The Director of CIS is committed to DIOSS on their LANS and hopes that future development work for end users can be distributed to the personal level (95% of their personal computers are IBM). He believes that IBM will announce a "4300 micro" which will be VM/DIOSS-oriented for a departmental processor.

- However, during this interview, he did express some major concerns about IBM when asked what reaction he would get if he called in vendors for the express purpose of discussing the problems of departmental processing.

  - "IBM has changed, they can't even talk with us about this area. If I called them in they would tell me when they can get me on their company jet and fly me somewhere, hand me some box seats for a baseball game, and leave thinking the whole situation is under control. They obviously don't understand what is going on." (He did not consider the System/36 worth discussing.)

  - On the other hand, DEC already has a presence in LANs and are more than willing to talk about specific situations. They have reviewed All-in-1 and are favorably impressed. Although performance was considered to be problem (measured by the number of active terminals), it was stated that "you can implement some major applications using it."

- So the company remains dedicated to the integration and restructuring of applications systems based on business needs. The emphasis is on information systems and not computer systems, and they seem much more interested in talking about what they are doing rather than about what they might do. The latest industry buzz words are all considered mere ripples in the "c" in cIMS; they seem more interested in real solutions to their problems than they are in "generic applications solutions."

IV COMPETITIVE ANALYSIS

IV COMPETITIVE ANALYSIS

A. GENERAL

1. COMPETITIVE CHARACTERISTICS

- The competitive environment within the departmental systems market is a fragmented one characterized by battles between numerous "johnny-come-lately" giants. As shown in Exhibit IV-1, the primary players in hardware/software/services are, in most cases, large, well-financed vendors who established themselves in different segments and then "discovered" departmental computing at a later date. One consequence of this history is competitive disarray whereby no one vendor dominates the scene.

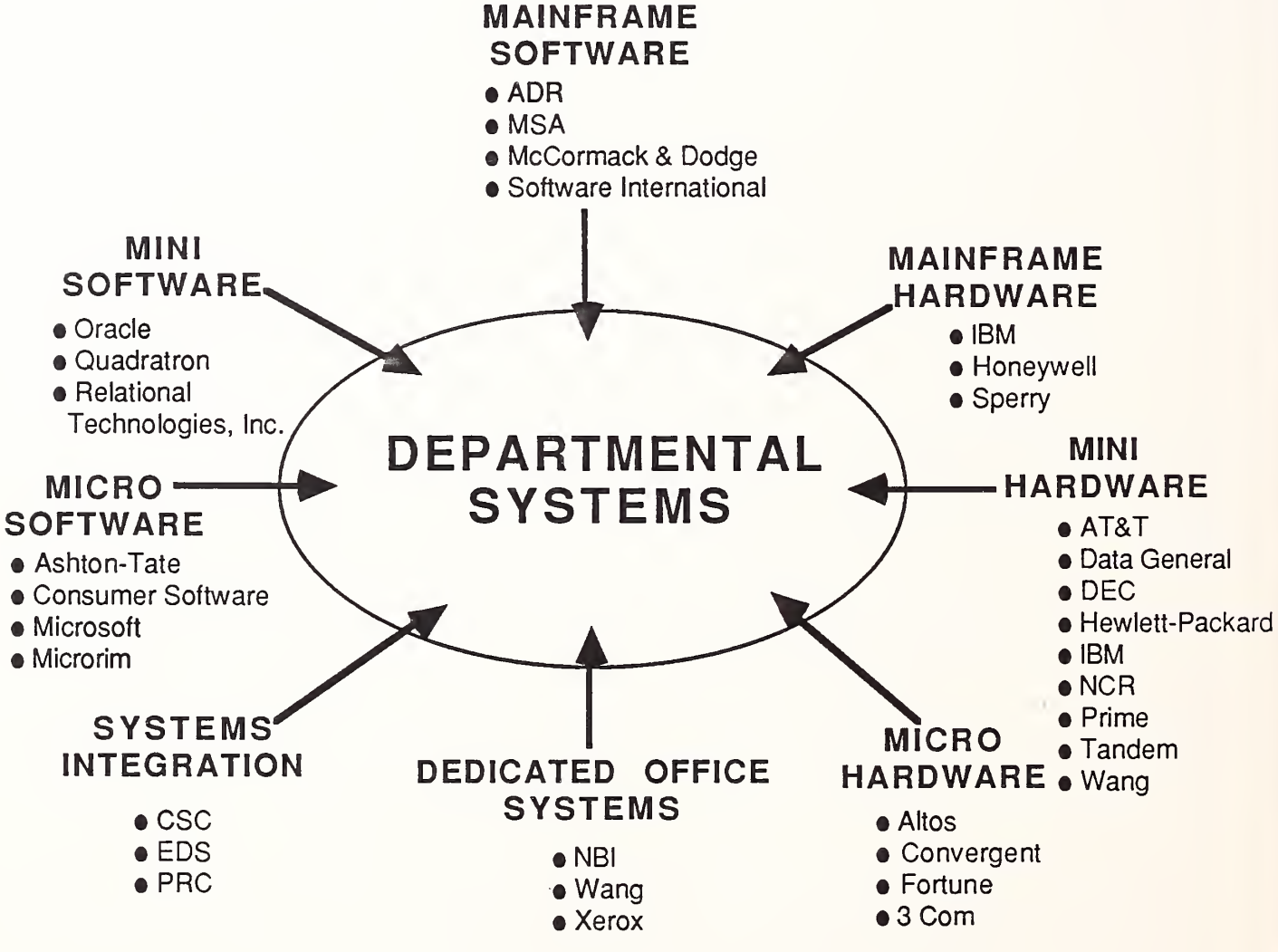
- Closer consideration of Exhibit IV-1 reveals a number of trends and developments that characterize the departmental systems competitive environment at the current time.

  - Integrated office system software is dominated by midrange hardware vendors.

  - Few microbased hardware or software vendors have successfully migrated upward to departmental systems thus far, although several (e.g., Ashton-Tate) have recently began making major efforts.

EXHIBIT IV-1

VENDORS CONVERGING FROM MULTIPLE DIRECTIONS (EXAMPLES)



- Good system compatibility among the three computing levels is a key user requirement that DEC is especially well positioned to exploit.

- Success in departmental systems requires solutions that interface well with hardware, IOS, and communications.

- Products that ease the ability of these diverse systems to talk to one another will do especially well in future years.

- One indicator of the size and nature of the departmental systems marketplace is the impressive successes that numerous vendors are having in the federal sector with office-based departmental systems offerings.

  - Computer Sciences Corporation has recently received several contracts that have important office automation aspects.

    . The Local On-Line Networking System (LONS) is a $186 million systems integration project for the Air Force involving the acquisition of IOS using off-the-shelf office support products.

    . In conjunction with Kodak, CSC is developing an electronic records management system under contract to the National Flood Insurance program. Incorporating a LAN and based on the Kodak Image Management System, the system will have the capability of retrieving and displaying microfilmed records within 45 seconds (compared to the two-day cycle under the existing paper-based system).

  - PRC has also had some significant integration successes, namely:

    . A $380 million contract from the Patent and Trademark Office.

- A $30 million contract to develop, install, and maintain an office automation and management reporting system for 100 Army Inspector General offices around the world.

- A $6 million contract for nationwide office automation for the Department of Agriculture.

- A local area network for the Executive Office of the President to control the proliferation of microcomputers.

- Wang's success include:

  - An Air Force contract valued at $480 million for 32-bit VS-based management information systems using Wang's professional microcomputers, office automation software, and networking. (Wang beat IBM's 4361 bid on this contract.)

  - A Veterans Administration award of $60 million to install and support integrated information processing systems that include VS minis, professional computers, local and remote WangNet, and Wang Office.

  - A contract for $14 million for VS computers, terminals, peripherals, and office software for the headquarters and 52 offices associated with the Office of the Secretary and Assistant Secretaries for Personal Administration and Human Development.

  - A $32 million contract with the Joint Chiefs.

  - A $17 million contract for 3,500 Wang microcomputers and WangPIC image processors.

- Data General is a subcontractor to the integrator, Tisoft (Fairfax, VA), on AMICUS II for the Civil Division of Justice.

  . This project will include telecommunications, word processing, electronic mail, and case management and tracking for the division's 900 lawyers. The total configuration consists of more than 35 Eclipse 32-bit MV superminis, 1,000 portable and stand-alone workstations, Wordperfect, Mathplan (Satellite Systems), and Xodiac and HYPERbus (Network Systems) LANs.

  . Data General also has OIS installations in the U.S. Senate (Eclipse MV/4000, MV/8000 II, MV.10000, and CEO) and NASA's Marshall Space Flight Center (MV/1000 and CEO).

- These awards will provide these vendors with not only impressive revenue gains but, perhaps even more importantly, will provide an experience base of complex departmental systems projects that will help establish a competitive edge for later migration to the commercial sector.

- An indicator of the diversity of the departmental systems competitive environment is the variety of vendors comprising the Top Ten list of office systems revenue producers to the federal government (see Exhibit IV-2). Within these ten leading vendors are two midrange hardware vendors, one mainframe hardware vendor, three professional services companies, two ex-dedicated word processing vendors, and one national telephone vendor.

2. VENDOR STRATEGIES

- The marketplace to date for departmental systems has been heavily hardware-oriented. However, INPUT believes the orientation will shift gradually to software and then to systems integration as firms seek increased work group productivity.

EXHIBIT IV-2

RANK ORDER OF LEADING FEDERAL OIS* VENDORS

CATEGORY/ VENDOR	1985 FEDERAL OFFICE SYSTEMS REVENUE** ($ Millions)
Hardware Orientation	
Wang	$152
IBM	135
Digital	60
Data General	36
Sperry	12
NBI	24
CPT	20
Xerox	15
Honeywell	10
AT&T	10
Software & Services Orientation	
PRC	28
CSC	22
SDC/Burroughs	12
Cullinet	10
Boeing	10
Lotus	8
McDonnell Douglas	6
EDS	4
Ashton-Tate	4
ADR	2

* Office Information Systems
** INPUT Estimate

- Generally speaking, the marketing strategies of vendors active in departmental systems can be classified as either product line extensions, product integration, or marketing alliances. Many vendors, such as the ones discussed below, utilize variations on all three strategies.

B. IBM

1. IBM IN TRANSITION

- IBM is in the midst of a full-scale "catch-up" strategy for departmental systems. This is the second time in less than five years that the computer giant has had to dilute its 20-year strategy of "mainframes forever." There is no doubt that IBM will eventually succeed in assuring its place as a major departmental systems vendor. The only issues are 1) how long will it take, and 2) how much market share at this level will it lose before its position becomes solidified.

- Recently, IBM has taken a number of steps to strengthen its departmental systems strategy. These steps have included:

  - Announcement of the IBM Token Ring LAN with gateways to midrange as well as mainframe processors, as well as other local area networks.

  - Announcement of new models, pricing, and interconnect capabilities for System/36 and System/38 for the purpose of providing additional power within the context of a connected world.

  - Announcement of APPC (Advanced Program to Program Communications) for allowing direct communication between peers in an SNA network.

- Announcement of the 9370 family of low-end processors that now allow users to run 370 programs on systems costing as low as $30,000 or as much as $9,000,000.

2. PROFILE OF IBM'S STRATEGY

- In response to users' demands and competitive inroads, IBM is encouraging a three-tiered departmental systems strategy that allows linking of mainframes, minis, and micros. Important components of this strategy include SNA, APPC, DISOSS, and PROFS.

a. SNA and APPC

- Two protocol products are inherent in IBM's present and future office interconnect strategies.

  - SNA is IBM's foundation for interconnection in the office environment. There are about 20,000 SNA installations in 1986. One concern relative to SNA's ability to handle future communications needs is its voice transmissions capability.

  - As users demand distributed data processing, the strategic implications of APPC (Advanced Program to Program Communications) become even clearer. APPC is key to IBM's current and future interconnect strategies in that it provides enhanced SNA support for distributed processing through the evolutionary addition to SNA of:

    . Logical Unit Type 6.2 (LU 6.2).

    . Physical Unit Type 2.1 (PU 2.1).

- Together, LU 6.2 and PU 2.1 provide the capability for direct communication (peer to peer) between users in an SNA network. This enables applications to

converse directly with other applications without the requirement for host intervention.

- IBM is using APPC to provide the foundation upon which to build additional distributed processing functions. For example:

  - DIA (Document Interchange Architecture) specifies how devices are to interchange content and data, i.e., documents.

  - SNADS provides the asynchronous store and forward capabilities for distributing documents throughout a network.

  - SNADS and DIA, in conjunction with DCA (Document Content Architecture), then provide a major part of the architectural definition for major office systems products such as DISOSS.

- Most of the other significant vendors in the office systems marketplace provide SNA, LU 6.2, and DCA/DIA support for their products for connecting to IBM equipment in the office environment.

b. DISOSS

- DISOSS (DIStributed Office Support Systems) is an interconnect product that is of primary importance to IBM.

  - It is a highly complex and highly functional host product for document filing, management, and distribution, providing text compatibility under SNA across computer levels.

  - It runs under DOS or MVS with CICS.

  - It is expensive to acquire ($45,000 license fee, $1,400 monthly charge), and the implementation process takes a long time; consequently, few users have installed it.

- Also impeding the growth of DISOSS is the fact that since it is an architectural type of product, there is a long selling cycle. Users must do a systems design of how it will be incorporated prior to its purchase, which at times creates a tough internal sell.

c. PROFS

- PROFS (Professional Office System), another strategic IBM product, is a VM product for the 43XX series of computers. It provides text processing, E-mail, and scheduling. Infocenter I is a decision support application that supports PROFS on the 43XX host.

  - Rolm recently announced phone mail support to PROFS--a sign that IBM is beginning to integrate Rolm products with key IBM products.

  - VM/PC was also announced by IBM in which a master tape from PROFS is put on a host and the program is downloaded to licensed users' disks.

  - IBM has also announced a bridge between DISOSS and PROFS for the transfer of documents.

d. Other IBM Connecting Strategies

- The major backbone of IBM's connectivity strategy involves architecture, protocols, and applications (SNA and DISOSS). These products are primarily host based. However, there are other connectivity strategies that will be of significance over the years.

- In 1990, INPUT anticipates that 70% of all micros (20 million) will be linked in some form--multiuser, micro-mainframe, PBX, LAN. IBM's strategy will ultimately include product offerings in all of these areas; presently, however, only its LAN strategy is obvious.

- IBM offers three different LAN products: cluster program, PC-Net, and Token Ring.

  - The Cluster Program is for sharing storage and exchanging files. It has a single network interface and can support six users. It will not, however, be a mainstream link product.

  - The PC-Net is for sharing information locally. It is based on broadband technology and distributed through retail channels. The product, however, lacks multiuser software.

  - The Token Ring is IBM's serious long-term LAN product. It is based on DOS 3.1 and NETBIOS, a network interface specification.

- IBM is targeting its Series I computer as a key to connecting offices via LANs. It is now DIA/DCA and SNADS supported.

3. CONCLUSIONS AND IMPLICATIONS

- A number of observations can now be made as a result of IBM's recent announcements coupled with INPUT's perspective on the competitive environment. For example:

  - IBM is still trying to keep control at the corporate level.

  - IBM's overall goal is to make the system transparent to the user. This goal has not yet been attained, but this is the direction IBM is heading.

  - IBM will continue to grow operating systems for the departmental offerings. Recent announcements regarding VM and IX/370 confirm this.

- When all is said and done, IBM wants to grow applications to larger machines in order to help lock in mainframe resources.

- APPC will, for the first time, allow others to come into IBM systems using IBM endorsed methods.

- A number of new architectures have been introduced by IBM within the past few years that will set the directions for the next decade. These architectures include communications (SDA), document exchange (DCA/DIA), printers (AFPA), data connectivity (DDM), peer communications (APPC), and processors (S/370).

C. DEC

- DEC's 32-bit VAX architecture is the company's primary strategic product line. The 8600 is the company's top-of-the-line product and significantly surpasses older products in features and processing power. It is based on ECL (Emitter Coupled Logic) technology for speed and processes at about 4.5 MIPS.

- The primary competition to DEC's supermini VAX 8600 is IBM's 4381 model 3.

- At the low end of the product line is the MicroVAX, a multiuser system that runs the MicroMVS operating system, or Ultrix, a UNIX-based operating system.

- Since the entire VAX architecture runs the VMS operating system, applications are transportable across the entire product line, making migration relatively easy.

- DEC's All-in-1 integrated office package offers applications such as E-mail, document processing, word processing, etc. on a DEC VAX running the VMS operating system with at least 2MB of dedicated internal memory. The All-in-1 Office Menu basic package is priced at about $15,000.

- From All-in-1's introduction, DEC has encouraged third parties to write software that could be integrated under All-in-1. Consequently, a large number of department-specific packages have been developed and DEC has begun to personally offer sales/marketing and finance/accounting packages.

- DEC has been very aggressive in the area of networking and has developed multiple gateways to access both data and text from IBM systems. DEC is selling its networking capability with the claim that it can do more with off-the-shelf products.

  - DECNET DOS VI.1 allows the IBM/AT to connect directly with Ethernet. The entire Digital Network Architecture is based on DECNET protocol which, in turn, is based on the OSI model for use in multivendor environments.

  - The External Document Exchange facility can access and edit DISOSS-type documents.

- Other DEC activities include the addition of fourth generation language products, including VAX Teamdata, VAX Rally, and VAX Cobol. In addition, DEC:

  - Announced a 200,000-page optical disk storage system for MicroVAX and VAX stations.

  - Provides A-to-Z, an integrated system for OEMs to use to migrate software to MicroVAX.

- Replaced their VAX 11/780 with a VAX 8200 uniprocessor and two dual processors, the 8300 and 8800. All-in-1 will eventually be offered on the 8800.

D. DATA GENERAL

- The Data General (DG) Eclipse family of minicomputers are targeted toward two major markets--the commercial market with the C/30 and the high-end scientific market with the S/280.

- DG's Comprehensive Electronic Office (CEO) integrates word processing, data communications, data analysis, and processing. CEO provides multivendor interfaces for connection with IBM PCs and for sending and receiving documents from noncompatible systems. Basic initial license fees are $20,000.

- CEO is considered one of the best integrated products at both the application and file levels, with a consistent user interface.

- In early 1986, DG announced a gateway to IBM's DISOSS for document transfer. Newly introduced products of voice store and forward software and voice/data terminals highlight the company's commitment to long-term overall office integration.

- The C/30 competes with IBM's System 36 and System 38, while the "S" series competes with the DEC PDP/11 and the Hewlett-Packard 1000.

- A major plus for the Eclipse series is their compatibility within the product line as well as with the 32-bit MV/Eclipse systems. This is a major selling point to users interested in a solid upward migration path.

- Data General's AOS/VS operating environment supports X.25, SNA, IEEE 802, MAP, and IBM's DCA/DIA.

  - Data General's Advanced Operating System/Distributed Virtual Storage (AOS/DVS) supports Ethernet and IEEE 802.3.

  - Data General's CEOWrite word processing software is now available under MS/DOS for Dasher/One, DG/One, and IBM/PC.

  - Data General's Xodiac Transport Service/SNA (XTS/SNA) links distributed processing systems into the SNA network.

- Data General's Dasher/One now extends the functionality of CEO to MS/DOS. It is an intelligent workstation for integration into distributed processing or agency computing environments. It is Eclipse-compatible.

  - Data General has also added Technical Electronic Office (TEO) which includes OIS-type functions for engineers.

  - Data General's 32-bit Eclipse MV/2000 computer is designed for four to twenty-four users in a departmental operating system. The MV/2000 Model 2 (aka Viking) is a 10 MIPS dyadic supermini.

- Data General now offers a voice/data terminal, Dasher D555, that operates in the CEO office environment and supports voice annotated text.

E. WANG

- In 1985 Wang, the long-time leader in word processors, added the VS65 system to its VS line of computers. The product is specifically aimed toward the office automation market along with an upgraded version of the model 15. The company is directly targeting IBM's System/36.

- All VS systems run the VS-DOS operating system. A version of UNIX System V (UVS) can also be run.

- The three major sets of software products offered by Wang for departmental processing include Integrated Information System (IIS), Alliance Software, and WangOffice.

  - IIS combines word and data processing on single systems.

  - Alliance offers visual memory, audio messaging, and calendering along with key word search.

  - WangOffice uses Wang Systems Networking for information and resource sharing. It is a comprehensive set of services that involves word processing, E-mail, and electronic file management. The WangOffice Assistant, which provided word processing on a scaled-down PC, supports multitasking.

- The company's stated long-term goal for office automation is the integration into systems of word/data/image/voice processing along with networking and with a special focus on human factors.

- Wang's multicomputer is the Resource Sharing Facility (RSF) for Release 7 of the VS operating system. It creates and permits access to a data base at the departmental level for 800-1,000 users. RSF also allows up to four VS super-minis to coexist.

- Wang supports 10 MIPS 802.3-standard Ethernet and IBM/PC Networks on its broadband WangNet. Wang's Professional Computer is somewhat IBM-compatible.

F. HEWLETT-PACKARD

- Hewlett-Packard's HP3000 models are the company's primary office automation products.
  - Models include Series 37, 39, 42, 48, and 68.
  - The products can be configured as program development systems, as production systems, and as a key component of a distributed processing environment integrating PCs.
- Office software for the HP3000 includes packages for manufacturing, finance, distribution, and office automation.
- The HP Personal Productivity Center for integrated office systems has received a major emphasis by Hewlett-Packard in the past 18 months.
  - The product is a combination of software, PCs, and a HP3000 to allow the sharing of data and peripherals.
  - Software includes word processing, DBMS, graphics, E-mail, and communications with IBM.
  - The system can be purchased as a bundled or customized office solution.
  - The HP3000 low-end model 37 has been a key hardware product for the office automation market, with a fully configured Personal Productivity Center System costing about $45,000.
- In the past 18 months, HP has also developed a set of integrated applications for personal computers. Called Execudesk, the set of programs has a

consistent user interface and the capability to allow users to add other application packages of choice to the Execudesk series of prepackaged programs.

- HP's communications capabilities are constantly being extended. The AdvanceNet network has all the functions of the older distributed services and adds advanced network control functions as well as interactive accessibility of IBM hosts and applications.

- Hewlett-Packard offers SNA Server, an interface between SNA/MVS and HP 3000, in both interactive and batch modes.

G. AT&T

- The AT&T 3B series of minis and micros have been traditionally sold primarily to the Bell Operating Companies. A variety of network products provide for communications between minis and other AT&T products as well as products from other vendors (such as IBM).

- The family is divided into three groups:

  - 3B2/300 supermicro.

  - 3B5 midrange superminis (100, 200, 300).

  - 3B20 series of high-end superminis.

- All but the model 3B20D run the UNIX System V operating system. The 3B20D incorporates the features of System V in UNIX RTR (Real Time Reliable) with extensions for real time, fault tolerant processing.

- AT&T networking products include:

  - 3BNet, a high-speed local area network that provides file transfer among 3B computers within the area of one-quarter mile.

  - Information Systems Network (ISN), a proprietary local area network for building complexes and campuses. It permits 3B computers to network with computers from other manufacturers.

  - PC Interface, a hardware/software link that interconnects the 3B/300 to personal computers running the MS-DOS operating system.

- The 3B series competes primarily with DEC VAX and low-end IBM 370 products. The 3B20D competes with Tandem TXP and Stratus computers.

- AT&T's advantage with the 3B series is the compatibility of the UNIX operating system for application and hardware migration. This same point is a disadvantage in that the success of the product line is based on the availability of quality application software for UNIX. The series does, however, have good networking and distributed processing capabilities.

H. TANDEM

- Tandem is approaching broader-based departmental system applications from its fault tolerant, on-line, transaction processing platform. Having been quite successful as a relatively isolated system dedicated to highly reliable computing, Tandem is now moving into the departmental systems mainstream with more powerful systems (e.g., the recently announced NON-STOP VLX system selling for close to $1 million) and with more connectivity to both micros and other mainframes. To strengthen both their systems and applications software offerings, they have undertaken an active third-party software program called "Alliance."

- In terms of market segments, Tandem will broaden its approach slightly, but will still focus primarily on finance, telecommunications, manufacturing, and retail. Within those targeted areas, Tandem is attempting to position itself as a "Total Solutions" vendor.

I. OTHER VENDOR ACTIVITY

1. CAPABILITIES

- Northern Telecom offers switching capabilities, voice annotation, and voice store and forward within an integrated PBX environment.

- Prime has repackaged its 2655 for office and CAD applications. The new 2450 is aimed at the DEC VAX market.

- Sperry offers Q-Office on the Series 5000 UNIX system for word processing, text composition, electronic mail, and windowing.

- Sperry uses SperryLink PC on the Series 1100 mainframe and DOPS/20 departmental system. MS/DOS and SperryLink files can be converted reciprocally, essentially making an electronic mail offering.

- Xerox now offers Ethernet for SNA and Digital environments.

- NCR's Comten and Office Systems Divisions are developing interfaces to DISOSS and PROFS.

- Honeywell's Office Management System (OMS) 22, 40, and 90 product lines have office processing capabilities and Docu-Link to share DISOSS-type formats in an SNA environment.

- Honeywell's line of microcomputers, the XP and AP, are IBM-compatible.

- Wang provides the means to connect PROFS and WangOffice.

- Harris sells Concept 4300, a multiuser, multitasking office automation system that runs Xenix or PC/DOS 3.1 connected via its Perspective product which supports IBM's NETBIOS and, in effect, integration.

- Datapoint provides a video/voice/data desktop workstation, MINX.

- Boeing uses DISOSS in Boeing Information Exchange, a multivendor network for Wang, Xerox, Hewlett-Packard, and IBM systems. Boeing has also been instrumental in advancing a Technical Office Protocol (TOP), along with the more noted Manufacturing Automation Protocol standard.

2. COOPERATIVE VENTURES

- CSC has signed a multimillion dollar contract with AT&T to provide market research, software design, turnkey software development, and the use of certain existing software to develop AT&T's OIS product. The software will run on UNIX System V and take advantage of AT&T's 3B processor and digital PBX.

- AT&T is supplying Genicom laser printers as the first step in its desktop publishing effort.

- Data General has acquired an interest in Dama Telecommunications (Parsippany, NJ). Dama makes digital voice/data communications and private network gear.

- Wang has joined with Hartford Technology to develop Professional Office Creation Environment, an applications development system that includes an IBM mainframe link, electronic mail, and text processing.

- Wang teamed with Telenova (Los Gatos, CA) for voice/data PBX tied to VS. The switch has an 18 MIPS Ethernet that can handle 120 handset/PC pairs.

3. SUMMARY OF UNIX ACTIVITY

- Many vendors have also developed UNIX systems as a solution to multivendor environments.

  - AT&T proclaimed UNIX System V as a standard.

  - Burroughs has the EX series.

  - Data General has DG/UX for Eclipse.

  - DEC has Ultrix on MicroVAX II as well as a version for its PDP-11 line.

  - IBM has PC/IX (from Interactive Systems) or Xenix (Microsoft). Series/1 runs IX or CPIX. Mainframes run VM/IX or IX/370. IBM's "Sailboat" project uses UNIX System V in a RISC workstation, principally designed for engineering, ranging from 1-25 MIPS and priced in the $15-70,000 range.

  - NCR's UNIX is Tower.

  - Sperry, using NCR, Computer Consoles, or Areta Systems UNIX versions, has UNIX on its 5000 and 7000 product lines.

  - Wang's only UNIX machine is the Advanced Professional Computer, which is IBM PC/AT compatible.

V TECHNOLOGY

V TECHNOLOGY

A. SYSTEMS HARDWARE

- The battle of the multiuser processors will continue during the next five years with no clear winner emerging. Minicomputers will compete with supermicros, local area networks, and micro-mainframe alternatives for departmental implementations. The net result will be much coexistence, with an emphasis on connectivity to whatever combination of processors an organization has installed.

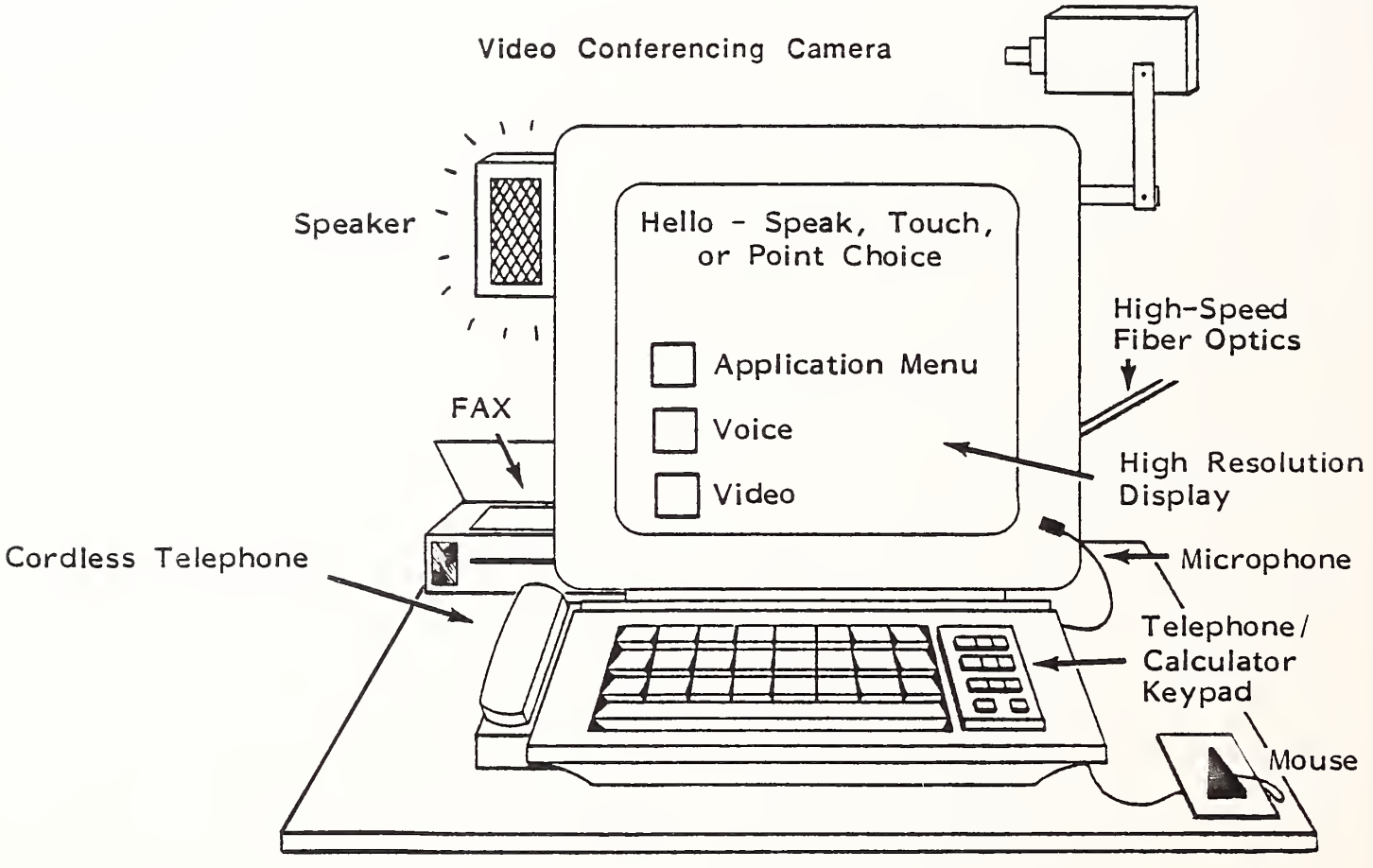
- Workstations will undergo rapid obsolescence as technology drives performance up and prices down throughout the 1986-1991 period. As shown in Exhibit V-1, the workstation of the late 1980s will make today's ubiquitous PC standard look hopelessly primitive. For example:

  - Popularity of workstations which use the new 32-bit chip technology (such as the Intel 30836) will bring powerful multiprocessing, multioperating system capabilities to a desktop system priced at under $10,000. The ease of connecting micros to minis and minis to mainframes will be significantly enhanced.

  - Improved video displays will render the ubiquitous 24 line x 80 character screen seriously outmoded by 1988. In its place as the preferred business systems display will be high resolution, multiple

EXHIBIT V-1

THE INTELLIGENT WORKSTATION OF THE LATE 1980s



page size screen that today is usually only found on costly engineering workstations.

- CD ROM will become an easily accessible mass storage device, as commonplace in 1988-1989 as hard disks are today.

- Scanners, speakers, cameras, and other devices will provide impressive multimode input and output options.

B. CONNECTIVITY

1. OVERVIEW

- The convergence of telecommunications and information processing technologies continues to accelerate.

  - Connectivity has become the byword of the entire computer industry.

  - Organizationally, the voice and data managers are now talking to one another and in many cases merging their groups to facilitate planning and implementation.

2. NETWORKS

- The emphasis on networking of the past is now giving way to internetworking--the process of connecting multiple exiting networks so that users may easily access resources on networks other than their own. Examples include LAN to LAN, LAN to VAN (Value Added Network), and LAN to WAN (Wide Area Network).

- Led by the telephone companies, the Integrated Services Digital Network (ISDN) is now becoming a reality in selected test installations around the country. ISDN integrates multisource, multimode voice/data traffic in a single system, providing both speed and cost benefits. For example, with ISDN a single installation, served with one cable, could transmit/receive PC information without a modem as well as transmit cable TV and specialty closed circuit signals.

- Organizations will construct more private networks as an alternative to using the Regional Bell Operating Companies (RBOCs) and/or AT&T. Exhibit V-2 shows that private or virtual private (dedicated services from an external vendor) corporate networks will increase from 39% of all networks in 1986 to 60% by 1991. Reasons why users will gravitate toward this type of solution include the desire for more control, decreased cost, increased security, and compatibility among operating business units.

- The application mix on networks will change during the balance of the decade (see Exhibit V-3). Data will become a larger part of the network traffic, growing from 20% in 1986 to 37% in 1991. (Although voice will decline as a percent of the total traffic, overall traffic will increase in absolute volume.) Important data-related applications will include:

  - Electronic mail, stimulated by the adoption of universal access standards.

  - Electronic data interchange (EDI), the transfer of business documents between partners.

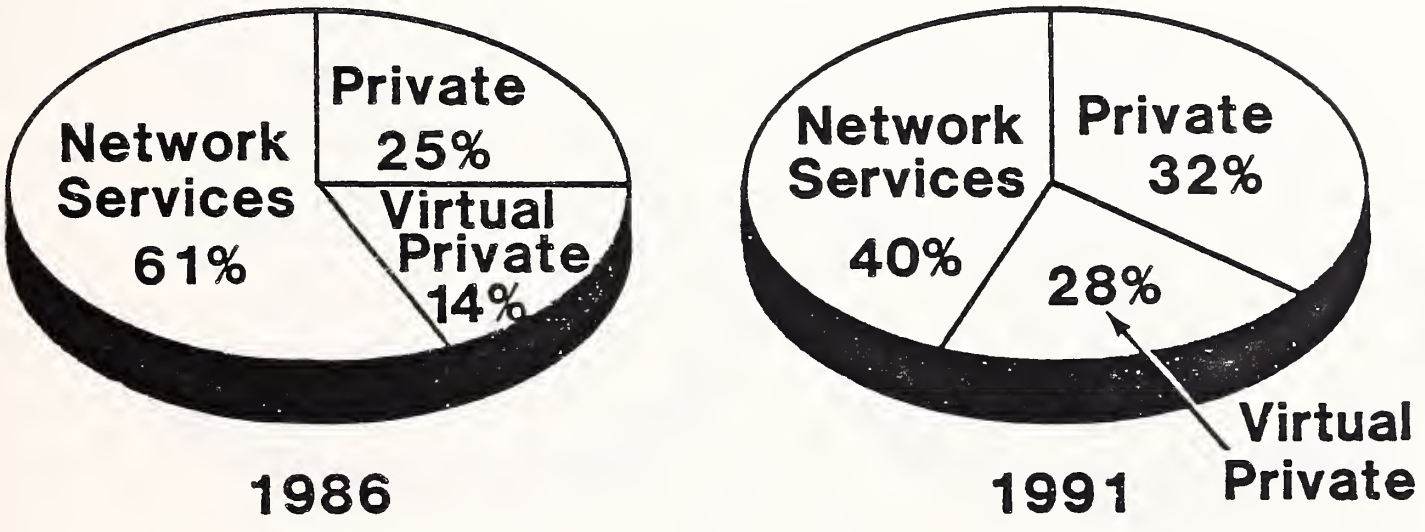
  - Graphics systems (e.g., connected CAD/CAM workstations).

  - Teleconferencing in modes such as computer, video, and voice.

EXHIBIT V-2

PRIVATE NETWORKS ARE EXPANDING

User Views

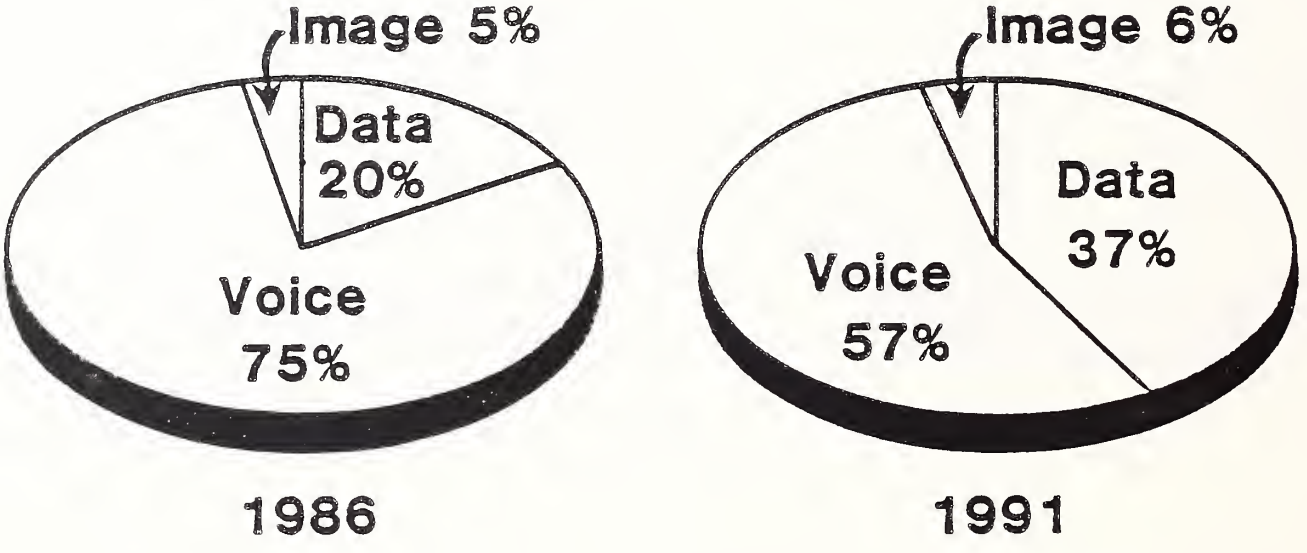


MSP3 Sw 5

EXHIBIT V-3

THE NETWORK APPLICATION MIX IS CHANGING

User Estimates



- New consumer-directed systems, such as credit card authorizations, point-of-sale recording and, ultimately, videotex.

- Other business and consumer telemetry applications, such as meter reading, security alarms, and remote fault diagnostics for equipment repair.

C. LOCAL AREA NETWORKS

- Although the popularity of local area networks runs a distant third to mini/supermicros and micro-mainframe as departmental systems computing delivery vehicles, the importance of LANs extends far beyond their market share. LANs play a crucial role in helping to make people "think" about connectivity as a major step forward in computing productivity. As a result, LANs are both the stimulus to increased departmental computing and the beneficiary of it.

- In spite of the numerous product announcements and widespread publicity enjoyed by LANs for the past 24 months, local area networks are still viewed as experimental by many users, including some from large, computer-sophisticated firms. Although conceptually LANs can be exciting, reality is more sobering. Barriers to rapid widespread LAN acceptance include:

  - Lack of perceived need in the short run to share information.

  - Lack of software.

  - Complexity of buying, due to absence of benchmarks, proliferation of products, and lack of in-house LAN experience.

  - Lack of standards.

- Increased demand on PC users to take advantage of system capabilities.

- Widespread use and acceptance of standalone systems.

- Perceived loss of control by individual PC users should they have to join a network.

- Most of these barriers will lessen over time. LANs are a viable route to effective departmental computing. However, the growth in their acceptance will be slow and steady, rather than explosive.

D. PBX DEVELOPMENTS

- Although widely championed in the past as an upcoming major connectivity option for departmental systems environments, PBXs have been slow in making noticeable inroads as alternatives to mini/supermicro, LAN, and micro-mainframe options.

- A number of new developments, however, will help stimulate the sale of PBXs as a major connectivity device. These factors include:

  - New PBX technology that integrates voice and data in a more cost-effective manner.

  - Availability of new voice/data office systems applications.

  - Extension of data/voice links to provide interconnections to other multiuser systems.

- The PBX of the future is shown in Exhibit V-4. It offers the potential to integrate a wide variety of computer and communications resources. However, PBX's entry to the departmental computing scene via the voice world has made its acceptance less than easy.

E. BARRIERS TO EFFECTIVE CONNECTIVITY

- Connectivity is a concept which is unusually simple to grasp and yet especially challenging to implement. While many technical challenges still remain to be solved, users will find that future barriers to connectivity are primarily management-oriented. Common barriers include:

  - Existence of voice and data as separate departments.

  - Failure to include telecommunications in early business and automation planning.

  - Lack of a top management-endorsed telecommunications policy specifying the role and nature of this technology in the business operations of the firm.

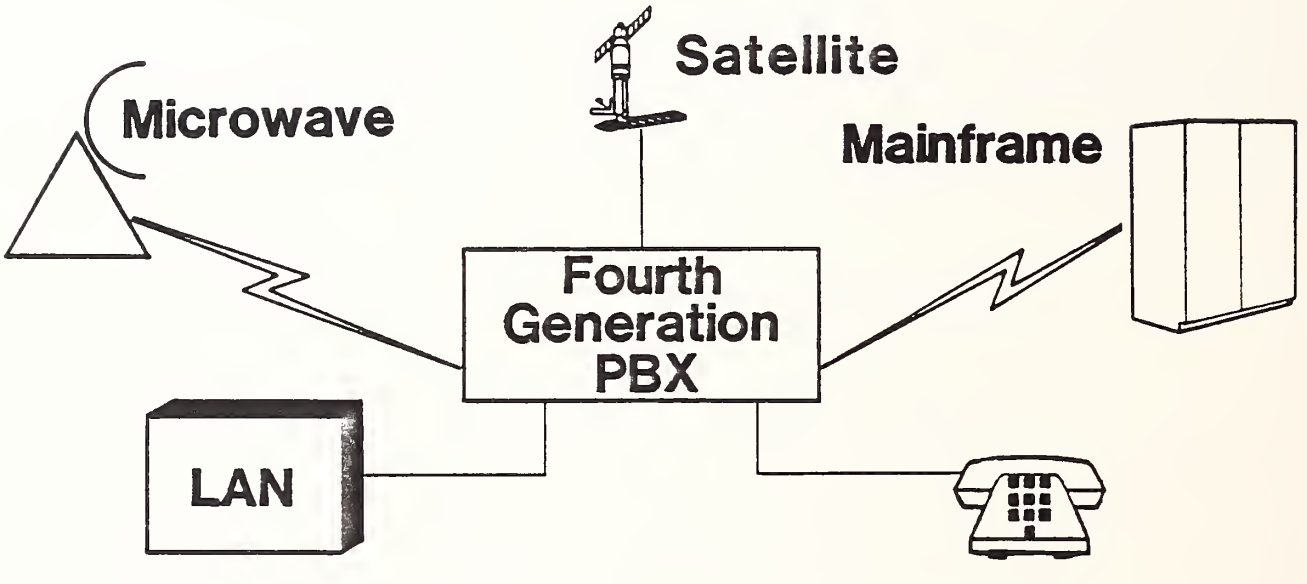
  - Workers' innate resistance to change, especially when it involves increased cooperation with coworkers historically ignored.

  - Installed base of historically incompatible vendors.

- The keys to success in overcoming these barriers is top management's endorsement of increased connectivity.

EXHIBIT V-4

FOURTH GENERATION PBX
THE VOICE/DATA MANAGER OF THE FUTURE



VI CONCLUSIONS AND RECOMMENDATIONS

VI CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

1. HARDWARE/SOFTWARE DIRECTIONS

- Today, the departmental systems market is characterized by diversity of both hardware and software. However, the major user driving force that will be shaping the future is accessibility/compatibility. As a consequence of these two realities, a number of developments can be expected during the next several years:

  - Cost-effective, transparent connectivity will be a major concern of users when evaluating departmental systems solutions.

  - Proprietary hardware and software architectures will dissipate in favor of open-ended approaches which encourage connectivity.

  - Software needs will drive hardware selections.

  - Integrated Office Systems, because of their ubiquitous functions and vendor-driven visibility, will become a common core interface to both industry-specific and cross-industry applications during the next five years.

2. THE NETWORK WILL BECOME THE SYSTEM

a. The Concept

- By the beginning of the next decade the role of the once powerful, preeminent corporate host computer will be that of a "slightly more equal" node on a powerful, far reaching, highly interconnected network of processors. We are now experiencing the beginning of the evolution toward the network becoming the system itself (see Exhibit VI-1). The networked system will have these characteristics:

  - All nodes will be close to equal in terms of accessibility.

  - Nodes may be bypassed if desirable.

  - The corporate host node will become primarily a data base server and network overseer.

- Just as the country's telephone system evolved over time from an individual collection of local telephone exchanges into a national network of relatively equal nodes, so too will the data processing systems of most progressive organizations.

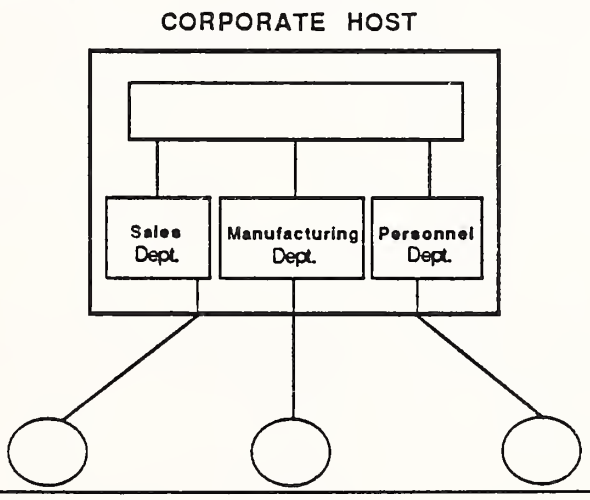
- A number of precursors already exist for us to study in order to glimpse the "network is the system" future.

  - DoD's ARPA (Advanced Research Planning Agency) is now linking via satellite the National Research Laboratories throughout the country. As a result, researchers at a terminal almost anywhere in the country can access Lawrence Livermore Labs in California as easily as Oak Ridge Labs in Tennessee. Each node is a massive computing resource in itself and can serve as a host to its own set of users. However, because the network is becoming the system, the user is relatively

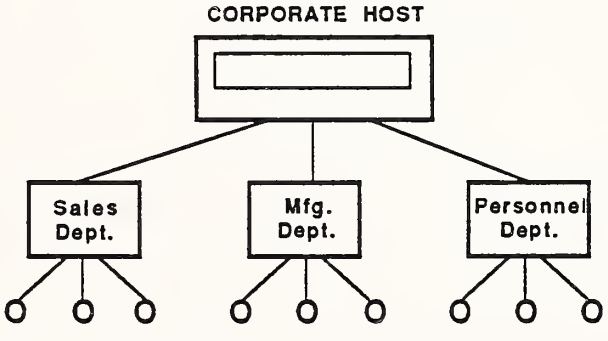
EXHIBIT VI-1

THE NETWORK WILL BECOME THE SYSTEM

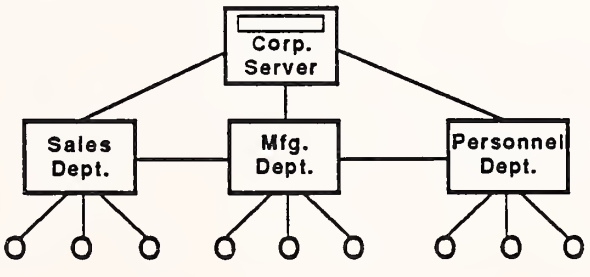
1960s and
1970s



MID
1980s



1990s



unconcerned about where information or processing power resides. They only want to know how to access it in a convenient way.

- Local area networks are, themselves, a microcosm of how entire information systems organizations will evolve. LANs have a file server, a "slightly more equal" node where communications control and large storage resides. Every other node, however, is a processing entity unto itself, yet is highly connectable to other resources in the system. Similarly, the corporate host of yesterday will become the network's "system server" of the future. Users can access it when necessary, but do not have to interact with it unless they want to.

b. Implications for Users

- The highly interconnected computing world of the future has a number of important implications to users responsible for planning and/or managing information systems activities. The implications are outlined below.

- The nodes will become almost equal in power over time. That implies careful planning, especially for nodes that begin as highly end-user oriented processing locations with little or no professional data processing management on-site.

- A full inventory of telecommunications skills are vital. The diversity of communications options, coupled with the rapid rate of innovation, requires continuous access to experienced personnel capable of assessing the business impact of new technological developments.

- Applications design and development will greatly increase in complexity as analysts must contend with a wide variety of distributed processors, data bases, and users.

- Issues such as the proper distribution of function, as well as data, will require high level management decisions concerning policies and standards.

- A premium will be placed on effective data tracking and security, two areas typically underestimated in terms of effort and cost.

- End-user education, training, and support must be given top priority; otherwise, the effectiveness of the distributed departmental systems will be seriously compromised.

B. USER RECOMMENDATIONS

1. PREREQUISITES FOR DEPARTMENTAL SYSTEMS SUCCESS

- Success in the world of interconnected departmental systems will require a number of factors, such as:

  - Broad management vision. Top business and information systems management must conceptualize and communicate a clear understanding of the proper role of automation in making the organization as productive as possible. Special emphasis, for example, must be placed on the need for increased working cooperation between departments.

  - Long-range departmental systems strategy. The establishment of processing priorities and the development of standards effectively commits an organization to a specific direction over the course of several years. It is vital that the organization develop a long-range departmental systems strategy that ensures that small steps taken each day will fit into the broader long-range plan.

- Integration of automation projects with the corporate business plan. Computer/communications technology is now too important to the success of an enterprise to be implemented independently of the firm's top business managers. Steps must be taken to ensure that the processing strategies directly support key business plans.

- Backbone communications network. Telecommunications systems are costly, complex, and time consuming to develop. It is especially important that the communications network be in place to serve today's needs immediately, and that it be rapidly expandable to serve tomorrow's needs without undue delay.

2. RECOMMENDATIONS TO USERS

- Set application priorities carefully. Departmental-based systems that promise to benefit multiple organizations should generally be given preference.

- Focus on the type of connectivity rather than the type of hardware when evaluating vendor offerings. Systems selected should be those that are most beneficial to the entire organization, not necessarily those that are optimum for one department at the expense of others.

- Provide strong corporate support regarding equipment evaluation, user education and training, standards requirements, and software support. Because the entire organization is so dependent on effective computer systems, it is important that departmental buyers avoid unintentionally going down deadend technological alleys, and/or budgeting les than is adequate to provide user assistance.

- Encourage end users to explore innovative solutions. Make sure they do not let the existence of standards and involved evaluation processes discourage them from considering offbeat solutions. Urge them to take their ideas to experienced computer professionals rather than prejudging them based on potentially incomplete, inaccurate, or obsolete information.

- Encourage end users to look beyond their own department for automation resources. The new connectivity options may make available numerous resources based in other areas that otherwise might be overlooked.

- Publicize departmental successes. The best way to encourage innovation is to show how others have done it successfully. Take pains to find out who has done especially well. Find out who, how, and why, and let others know so that they might be stimulated to do likewise.

- Plan new facilities with automation in mind. Significant amounts of both time and money can be saved when communications, power, space, furniture, and other physical aspects of automation are built into buildings prior to their occupancy.

APPENDIX A: DEFINITIONS

APPENDIX A: DEFINITIONS

- INFORMATION SERVICES--Computer-related services involving one or more of the following:

  - Processing of computer-based applications using vendor computers (called "processing services").

  - Services that assist users in performing functions on their own computers or vendor computers (called "software products" and/or "professional services").

  - Services that utilize a combination of hardware and software, integrated into a total system (called "turnkey systems").

A. USER EXPENDITURES

- All user expenditures reported are "available" (i.e., noncaptive, as defined below).

- NONCAPTIVE INFORMATION SERVICES USER EXPENDITURES - Expenditures paid for information services provided by a vendor that is not part of the same parent corporation as the user.

- CAPTIVE INFORMATION SERVICES USER EXPENDITURES - Expenditures received from users who are part of the same parent corporation as the vendor.

B. DELIVERY MODES

- PROCESSING SERVICES - This category includes remote computing services, batch services, processing facilities management, and value-added networks (VANs).

  - REMOTE COMPUTING SERVICES (RCS) - Providing computer processing to a user by means of terminal(s) at the user's site(s) connected by a data communications network to the vendor's central computer. There are four submodes of RCS, including:

    . Interactive - Characterized by the interaction of the user with the system for the purpose of problem-solving, data entry, and/or transaction processing. The user is on-line to the program/files. Computer response is usually measured in seconds or fractions of a second.

    . Remote Batch - A service in which the user hands over control of a job to the vendor's computer, which schedules job execution according to priorities and resource requirements. Computer response is usually measured in minutes or hours.

    . Data Base - Characterized by the retrieval and processing of information from a vendor-provided data base. The data base may be owned by the vendor or a third party.

. User Site Hardware Services (USHS) - Offerings provided by RCS vendors that place programmable hardware on the user's site (rather than in the vendor's computer center). USHS offers access to a communications network, access through the network to the RCS vendor's larger computers, and significant software as part of the service.

- BATCH SERVICES - This includes computer processing performed at vendors' sites of user programs and/or data that are physically transported (as opposed to electronically by telecommunications media) to and/or from those sites. Data entry and data output services, such as keypunching and computer output microfilm processing, are also included. Batch services include those expenditures by users who take their data to a vendor site that has a terminal connected to a remote computer for the actual processing.

- PROCESSING FACILITIES MANAGEMENT (PFM) (also referred to as "resource management" or "systems management") - The management of all or a major part of a user's data processing functions under a long-term contract (more than one year). This would include both remote computing and batch services. To qualify as PFM, the contractor must directly plan, control, operate, and own the facility provided to the user, either on-site, through telecommunications lines, or in a mixed mode.

- VALUE-ADDED NETWORKS (VANs) - VANs typically involve common carrier network transmission facilities that are augmented with computerized switching. These networks have become associated with packet-switching technology because the public VANs that have received the most attention (e.g., Telenet and TYMNET) employ packet-switching techniques. However, other added data service features such as store-and-forward message switching, terminal interfacing, error detection and correction, and host computer interfacing are of equal importance.

- Processing services are further differentiated as follows:

  . Cross-industry services involve the processing of applications that are targeted to specific user departments (e.g., finance, personnel, sales) but that cut across industry lines. Most general ledger, accounts receivable, payroll, and personnel applications fall into this category. Cross-industry data base services, for which the vendor supplies the data base and controls access to it (although it may be owned by a third party), are included in this category. General purpose tools such as financial planning systems, linear regression packages, and other statistical routines are also included. However, when the application, tool, or data base is designed for specific industry use, then the service is industry-specific (see below).

  . Industry-specific services provide processing for particular functions or problems unique to an industry or industry group. Specialty applications can be either business or scientific in orientation. Industry-specific data base services, for which the vendor supplies the data base and controls access to it (although it may be owned by a third party), are also included under this category. Examples of industry-specific applications are seismic data processing, numerically controlled machine tool software development, and demand deposit accounting.

  . Utility services are those for which the vendor provides access to a computer and/or communications network with basic software that enables users to develop and/or process their own systems. These basic tools often include terminal-handling software, sorts, language compilers, data base management systems, information retrieval software, scientific library routines, and other systems software.

- SOFTWARE PRODUCTS - This category includes users' purchases of applications and/or systems software that is sold by vendors as standard products intended for use by different organizations. Included as user expenditures are lease and purchase expenditures as well as fees for work performed by the vendor to implement and maintain the package (when such fees are either bundled as part of the product price or offered on an annual subscription basis). Fees for work related to education, consulting, and/or custom modification of software products are counted as professional services provided such fees are charged separately from the price of the software product itself. There are several subcategories of software products, including:

  - APPLICATIONS SOFTWARE PRODUCTS - Software that performs a specific function directly related to solving a business or organizational need. Applications software provides information directly for use by the end user. Applications software products classifications are:

    . Cross-Industry Products - Used in multiple user industry sectors. Examples are payroll, inventory control, and financial planning.

    . Industry-Specific Products - Used in a specific industry sector such as banking and finance, transportation, or discrete manufacturing. Examples are demand deposit accounting, airline scheduling, and materials resource planning.

  - SYSTEMS SOFTWARE PRODUCTS - Software that enables the computer/communications system to perform basic functions which are interim steps to providing the end user with "answers" sought. Systems software product classifications are:

    . Systems Control Products - These products function during applications program execution to manage the computer system

resource. Examples include operating systems, communication monitors, and emulators.

- Data Center Management Products - These products are used by operations personnel to manage the computer system resources and personnel more effectively. Examples include performance measurement, job accounting, computer operations scheduling, and utilities.

- Application Development Products - These products are used to prepare applications for execution by assisting in design, programming, testing, and related functions. Examples include languages, sorts, productivity aids, data dictionaries, data base management systems, report writers, and retrieval systems.

- PROFESSIONAL SERVICES - This category is made up of modes in the following categories:

  - SOFTWARE DEVELOPMENT - This service develops a software system on a custom basis. It includes one or more of the following: user requirements, system design, and programming.

  - EDUCATION AND TRAINING SERVICES - These services help people acquire new skills, techniques, or knowledge related to computers. This definition does not include services to educational institutions. (This latter market is included in the education (industry-specific) segment.)

  - CONSULTING SERVICES - Consultants advise clients on computer-related issues that are usually management-oriented. Feasibility studies and computer audits are examples of services provided.

- PROFESSIONAL SERVICES FACILITIES MANAGEMENT (PSFM) - This is counterpart to processing facilities management, except that in this case the computers are owned by the client, not the vendor; the vendor provides human resources to operate and manage the client facility.

- TURNKEY SYSTEMS (also known as Integrated Systems) - A turnkey system is an integration of systems and applications software with CPU hardware and peripherals packaged as a single applications solution. The value added by the vendor is primarily in the software and support. Most CAD/CAM/CAE systems and many small business systms are turnkey systems. This does not include specialized hardware systems such as word processors, cash registers, or process control systems, nor does it include Embedded Computer Resources for military applications. Turnkey systems are available either as custom or packaged systems.

  - Hardware vendors that combine software with their own general purpose hardware are not classified by INPUT as turnkey vendors.

  - Turnkey systems revenue is divided into two categories.

    . Cross-industry systems--that is, systems that provide a specific function that is applicable to a wide range of industry sectors such as financial planning systems, payroll systems, or personnel management systems.

    . Industry-specific systems--that is, systems that serve a specific function for a given industry sector such as automobile dealer parts inventory, CAD/CAM/CAE systems, or discrete manufacturing control systems.

  - Revenue includes hardware, software, and support functions.

- SYSTEMS INTEGRATION - Services associated with systems design, integration of computing components, installation, and acceptance of computer/communication systems. Systems integration can include one or more of the major information services delivery modes--professional services, turnkey systems, and software products. System components may be furnished by separate vendors (not as an integrated system by one vendor, called the prime contractor); services may be furnished by a vendor or by a not-for-profit organization. Integration services may be provided with related engineering activities, such as SE&I (Systems Engineering and Integration) or SETA (Systems Engineering and Technical Assistance).

C. OTHER CONSIDERATIONS

- When questions arise about the proper place to count certain user expenditures, INPUT addresses them from the user viewpoint. Expenditures are then categorized according to what users perceive they are buying.

APPENDIX B: ANALYTICAL FRAMEWORK FOR DEPARTMENTAL SYSTEMS PLANNING

APPENDIX B: ANALYTICAL FRAMEWORK FOR DEPARTMENTAL SYSTEMS PLANNING

A. DEPARTMENTAL SYSTEMS CONTEXT

- Departmental processors fall naturally into Level II (minicomputers) of the network hierarchy INPUT has been presenting in various reports for the last 10 years. The confusion, and even chaos, which currently exists concerning "departmental processors" and LANs in general is primarily the result of the continued resistance to minicomputers assuming their "proper place" in the network hierarchy. With every conceivable type of hardware and software converging on "departmental systems," it is not surprising that there is a great deal of turbulence and an ill-defined market.

  - For example, IBM's strategy has included multiple approaches:

    . The original SNA strategy was to put a controller (3790 and later the 8100) in the department and extend the processing power of the central mainframe to the end user.

    . PCs used as intelligent workstations connected to the mainframe are deemed to make Level IIs (minicomputers) unnecessary. (The PC AT was limited in the number of terminals supported to protect the 8100, but that has not worked too well.)

. When it became apparent that these essentially mainframe-oriented approaches were not competitive with minicomputers in providing Level II functions, the System 36 was promoted as a departmental processor with predictable unsatisfactory results.

. Then, of course, there is always the low-end mainframe (connected to the large host) with its "mainstream software" and associated overhead which has thus far proved noncompetitive but will unquestionably be resurrected when we get a 43XX desktop.

- All of this activity on the part of IBM is a clear indication that minicomputers have a proper place in the processing hierarchy, and an analysis of the tools needed to improve productivity in office functional categories will reveal what that role is.

• Exhibit B-1 presents a modified version of INPUT's network hierarchy systems category (Level IV and V terminals are not shown, and the human level is added). The functional categories are distributed to appropriate levels within the hierarchy based upon which level within the hierarchy currently has the most impact upon productivity as measured by the performance systems category.

- This exhibit illustrates the impact of word processing on the typing/data entry and report preparation functional categories and the lack of significant improvement in human productivity in the other functional areas.

- However, the primary purpose of the chart is to depict the current distribution of the key analysis and decision-making functional category over the processing hierarchy.

EXHIBIT B-1

NETWORK FUNCTIONAL DISTRIBUTION

Network Level	① Analysis & Decision Making	② Report Preparation	③ Dictation	④ Typing/ Data Entry	⑤ Copying/ Info. Entry	⑥ Info. Handling Storage	⑦ Telephone	⑧ Inter-personal Comm.
Level I Mainframes	Data Bases, Information Centers							
Level II Minicomputers	Interactive Computation							
Level III Intelligent Workstations	Spread-Sheets	X		X				
Humans White Collar Workers	X		X		X	X	X	X
Percent of Office Personnel Expense	22.1%	17.0%	0.3%	3.8%	2.2%	14.6%	14.9%	25.1%

- Level Is (mainframes) remain the primary repository of the data bases used for planning and control (operational control and decision support systems).

- Level IIs (minicomputers) have had significant impact on the analysis fucntion by providing interactive computation capability to engineers, scientists, and technicians over the years. (They were the original "departmental processors" the central DP department was always trying to replace with mainframe timesharing.)

- Level IIIs (intelligent workstations and standalone personal computers) have assisted in the analysis function by providing the computational capabilities of spreadsheet packages to accountants and planners. (It is important to recognize that spreadsheets present a matrix view of data to users which is more compatible with scientific and engineering computation than are the sequential and data model views of the mainframe systems.)

- Humans still perform the most critical functions in the analysis and decision-making process by looking at the numbers, reaching conclusions, and making the actual decisions.

- Most current efforts to improve the analysis and decision-making function are directed at micro-to-mainframe links and expert systems, but despite the promotion of "expert systems" and micro-to-mainframe connections, there are few (if any) analytical packages that truly integrate a number of "utilities" into a complete set for business decision makers.

- At this point, it should be pointed out that our general rule about productivity improvement being accompanied by a decrease in paper

use can be demonstrated by the progress we have made to date. White collar workers are not scribbling as many letters, memos, and reports on pads of paper; accountants and planners aren't using as many paper spreadsheets; clerks aren't filling out as many data entry forms; and there aren't many punch cards around anymore.

- Exhibit B-2 establishes the attributes of the network hierarchy based on appropriate systems categories. It is necessary to understand these attributes in order to better understand the role of departmental processors in the hierarchy.

  - General Systems Theory (GST) states that all systems exhibit parallel trends of progressive centralization, differentiation, integration, and mechanization. Since these trends exist in all systems, it is possible to consider the hierarchical network as a single system and state that:

    . Level I mainframes are the result of progressive centralization (described in GST as the development of a "leading part").

    . Level II minicomputers exhibit both differentiation (described in GST as the tendency for the parts to become more specialized) and integration (described as the tendency for the parts to become more interdependent).

    . Level III intelligent workstations demonstrate the trend toward mechanization (described as the tendency for parts of the system to perform a single function).

    . Of course, the individual levels can be viewed as systems and will also demonstrate all four GST trends, but the central, and essential, role of Level II minicomputers in a "proper" hierarchical network cannot be denied.

EXHIBIT B-2

ATTRIBUTES OF NETWORK HIERARCHY

Network Level	(A) GST	(B) Quality	(E) Software Hierarchy	(H) Systems Type	(K) Performance	(J) User Set
Level I	Centralization	All	SNA DBMS Data OS Applications	Batch Transaction	Hardware Software Institutional	Programmers Systems & Procedures Analysts
Level II	Differentiation and Integration		LANs Industry-Turnkey Information O/S Applications	Interactive Transaction Real Time	Work Unit	Scientific Engineering
Level III	Mechanization		SNA O/S Languages-DSS Applications	Decision Support	Human-Machine Dyad	All
Human			Knowledge Users	Expert	Human-Machine Dyad	All

- There is currently a tendency to place all responsibility for quality at Level I. The central IS function is being held accountable for "computer reports" regardless of where they were produced, and the use of "corporate data" will only increase this tendency regardless of how those data are processed. There is something of a "cat and mouse game" going on as the central IS function attempts to shift responsibility (or demand control) and the end users attempt to "control their own destinies" and yet keep the IS function responsible for any quality problems. Level II departmental processors have an important role to play in quality control. INPUT describes quality as including:

  . Objectives.

  . Data/information/knowledge.

  . Auditability.

  . Measurement.

  . Feedback loops.

  . Validity/reliability/predictability.

  . Security/privacy.

- INPUT first used concepts of GST for analysis purposes in Market Impacts of IBM Software Strategies, 1984, and that report also defined the software hierarchy systems category. That category encompasses everything from SNA and operating systems down through the end users connected to the network. The subsets within that category are normally distributed over the network hierarchy as follows:

- SNA is designed primarily to support Levels I and III and to reduce the importance of Level II minicomputers in the network hierarchy.

- Operating systems are proliferating at various levels of the network as described in INPUT's report IBM Operating System Strategies.

- DBMSs are concentrated at Level I and, considering the potential problems with distributed data bases, it is probably just as well. But, departmental software is obviously dependent upon the effective distribution of data from mainframes.

- Languages and Decision Support Systems (Languages/DSS), despite current concentration of implementation at Levels I and II, are proliferating at Level III. That is the proper place for the human-machine interface, since languages will be the tools of mechanization for "expert systems."

- Industry turnkey systems are becoming essential as offices really become automated. This is clearly demonstrated by comments from vendors concerning the fact that "automated" means different things to different organizations and that current products must be "individualized." This is what differentiation is all about, and it will be concentrated at Level II.

- Applications (by common industry definition and not that of the personal computer software vendors) will be spread across all three hardware levels (Levels I, II, and III); that is what "cooperative processing" is all about, but it isn't here yet. (IBM would naturally like to see this cooperation concentrated at Levels I and III and that is what micro-mainframe links is all about.)

. Data/information/knowledge will tend to be concentrated as follows as networks evolve: data will continue to be concentrated at Level I, information will begin to concentrate at Level II (where the file cabinets are now), and knowledge will continue to be concentrated in human brains.

. Users will continue to be human beings in the foreseeable future (as opposed to having expert systems call on various levels in the hierarchy and make automatic decisions), and human beings will provide the primary knowledge base on the network (that is the reason they were included in the "software" hierarchy to begin with and why they are included in Exhibit B-2).

. For purposes of later discussion, LANs (a subset of SNA) are shown at Level II where minicomputers serve as the tool for integration of Level III intelligent workstations.

- Systems types (as opposed to applications) will tend to concentrate in the manner depicted in Exhibit B-2. This was explained in some detail in INPUT's recent study, IBM Operating Systems Strategies, and is presented here primarily to bring the role of humans more clearly into focus. The primary "expert systems" in the foreseeable future will be associated with the "knowledge bases" and the knowledge bases are in human brains. Therefore, the "nonexpert" user of the network will need to be able to locate on-line knowledge bases (human brains); this will be an important function of departmental software.

- The performance systems category has been discussed at some length earlier in this section and is depicted in the exhibit primarily to make an essential point--while LANs and departmental processors have become somewhat synonymous, work units are not necessarily synonymous with LANs. There is no reason that work units (or depart-

ments) have to be concentrated in a physical location. In fact, one of the primary benefits of computer/communications networks is to permit flexible work units which are not restricted by geography. Therefore, while the term "departmental software" is used, the software extends beyond LANs and the physical confines of buildings.

- The user set systems category is presented in Exhibit B-2 to illustrate both the problem and the opportunity of departmental software as it applies to Level II. The population of programmers and analysts competent to build major office systems is relatively inexperienced in the use of minicomputers. Most current users of minicomputers (scientists and engineers) are neither interested in nor qualified to develop complex commercial applications systems (tools - maybe, applications - no), and commercially-oriented end users are familiar primarily with Level III. That means that if Level II minicompuers are to play their proper role in a processing hierarchy, non-IBM hardware and independent software vendors have an exceptional opportunity in departmental software development.

B. ENVIRONMENTAL OPPORTUNITIES

- Opportunities for departmental software are influenced by three factors:

  - The potential of current and prospective computer/communications networks to improve white collar productivity.

  - The proper (and cost-effective) role that departmental processors (minicomputers by our definition) should play in the network hierarchy.

  - The impact (both positive and negative) of IBM's apparent and persistent strategy of limiting the effectiveness of departmental processors in the network hierarchy.

- The functional analysis of the current status of productivity improvement (see Exhibit B-1) suggests that the mechanical aspects of report preparation and typing/dictation are being handled quite well by Level III workstations, and dictation has already been ruled out as an area where significant productivity improvements can be achieved. Fortunately, four of the remaining five functional areas (copying/information entry, information handling and storage, telephone, and interpersonal communications) can be lumped together in terms of providing a solution, and new technology of significance is becoming available. The last category (analysis and decision making), while complex, has clearly understood problems which need immediate attention, and those problems can be alleviated during the implementation of the new technology mentioned above.

- In April 1983, INPUT published Impact of Upcoming Optical Memory Systems which explained in detail the potential of this new technology and forecast availability of various systems incorporating that technology. Three years later, those forecasts (including availability of erasable media) appear to be pretty much on target. It is beyond the scope of this study to repeat the analysis which makes us so enthusiastic about the fundamental change in media except to say it will permit the reduction of paper use in the office, and that current CD ROM systems are the harbinger of much bigger things to come--soon. Our analysis of what this will mean to the four areas which were lumped together above are as follows:

  - When it becomes possible to store paper documents on-line on optical media that is cheaper than the cost of paper itself, and it becomes apparent that transmitting those documents is cheaper than handling them (or sending them through the mail), departments which handle large quantities of paper documents (and who doesn't) will invest in systems which eliminate (or reduce) paper. While information handling and storage represent only 14.6% of office personnel expense, the cost was $167.9 billion in 1981, and it has certainly increased since then.

That is a lot of potential money to invest in electronic filing and retrieval systems and in associated software to manage and control the information flow.

- Once the documents are on-line, it won't be necessary to walk to the copier, and some recent studies have indicated that the ready availability of text documents on line has led to printing of multiple copies. This may not be effective at the hardware/performance level, but it does indicate that "convenience copiers" may be a misnomer. With the availability of images and improved graphics and workstations readily available, the $25 billion personnel cost of copying can also contribute to the cost justification of "electronic offices."

- INPUT has long believed that electronic mail service, properly employed, will reduce time spent on the telephone. This, of course, assumes that intelligent workstations are as readily available as telephones. (Experience at Stanford University, which has appropriate terminals available for all faculty and administrative personnel indicates that this is true for telephone "conversations.") It seems logical to assume that the availability of page images and graphics would make the use of computer/communications networks even more attractive because of the superiority of visual information (pictures are better than words). Therefore, the elimination of paper in the office will also tend to diminish the time spent on the telephone.

- Even with today's computer/communications networks, there is a significant trend where effective electronic mail systems have been installed (for example, Stanford) and personal computers are readily available--personnel frequently elect to work at home. There they can go through their "in baskets," handle their correspondence, communicate with other members of their work unit, eliminate commute time, and avoid interruptions. (Which is just another way of saying that interpersonal communications are reduced because casual

conversation in the office is a substantial portion of the $288 billion now attributed to this functional area.) It is INPUT's opinion that the "electronic office" will tend to reduce time spent in interpersonal communications for the following reasons:

- People staring at a workstation screen "appear" less interruptible than someone staring into space or fiddling with a piece of paper and, therefore, are less likely to be interrupted.

- People sitting at terminals are, in fact, less interruptible--ask any spouse who has attempted to interrupt an on-line terminal session.

- There will be less reason for meetings because "visuals" and electronic black boards will permit diagrams and scribbling to be shared in real time.

- Given software facilities which will permit browsing through information (as well as retrieving data) and locating specific knowledge sources on the network, executives will not be so inclined to get everyone together to discuss things.

- Combined with the tendency for work unit dispersion permitted by computer/communications networks, the electronic office will tend to reduce interpersonal communications.

- Therefore, it appears that the availability of cheap on-line storage will not only reduce paper usage and improve information flow, but has the potential for reducing both telephone and face-to-face communications. However, intelligent systems work (software) will be required if some of the pitfalls of the technology are to be avoided.

- In addition, the fact that information flow may be improved by substituting electronic media for paper does not mean that the quality of the information being communicated necessarily improves--quite the contrary. As volume and distribution increase, so does entropy. The potential for deterioration of data and information quality is a clearly recognized problem of the analysis and decision-making function. The design of systems to support the electronic office must recognize (and avoid) this potential problem if those systems are to be effective (and used). It is INPUT's conclusion that Level II minicomputers (departmental processors) have an essential role in both the implementation of the electronic office and in controlling the quality of data and information.

- As we progress toward the electronic office, the need for custom systems will become increasingly apparent. Even casual analysis of the attributes of Level II minicomputers (row 2 of Exhibit B-2) will reveal why departmental processors will be so important.

  - They are the natural tools for differentiation (customization of applications) and the appropriate engines of integration for the work unit (LAN or geographically dispersed).

  - The elimination of paper in certain departments (for example, insurance claims processing) will require detailed analysis of current paper-based systems and procedures and a customized system (turnkey). Minicomputers (and their operating systems) have proven significantly more effective in the highly interactive environment.

  - Once the paper documents have been eliminated, the need for fault tolerant systems becomes essential, since all work will cease if the system goes down. Batch-oriented mainframes (and operating systems) have not had a good reputation for nonstop operation and certainly are not cost-effective because of operating systems overhead.

- The management of the information base implies image storage and retrieval (electronic file cabinets), and it is hard to envision either the centralization (to Level I) or the duplication (to Level III) of departmental files as being either cost-effective or good systems design.

- Level II minicomputers are essential for network management of all communications (voice, data, and image), and this will be especially true once these communications become integrated.

- In addition, while data and information quality control is currently centralized at Level I, that very concentration becomes part of the quality control problem when (and if) micro-mainframe links permit distribution of centralized data and information. The reasons for this are as follows:

  . The jump from easy-to-use Level III software to complex Level I software (where IBM has adopted a dual DBMS strategy) makes the misuse and/or misunderstanding of data and information highly probable.

  . Distribution of data and information from Level Is to multiple Level IIIs within operating departments leads directly to the synchronization and integrity problems which are feared.

  . In addition, the security problems associated with direct distribution to Level III are horrendous.

  . It is INPUT's position that the "orderly distribution" of data requires an intermediate level, and that intermediate level is the departmental processor.

. Therefore, Level II processors have a significant role to play in data and information quality control.

- The theme of IBM's entire hardware/software strategy is "evolution and not revolution." This may sound nice, but it is difficult to evolve during a time of technological revolution, and optical memories will have more impact on office systems than the personal computer. As IBM evolves during this period, there will be substantial windows of opportunity, especially for software developers. INPUT defined these general opportunities in Market Impacts of IBM Software Strategies, 1984, by breaking IBM's software strategy down into four strategic periods, as shown in Exhibit B-3.

- A brief summary of those opportunities is as follows:

  - During the SNA/DDP Strategic Period (present through 1990), IBM's strategy is in place and it continues to emphasize centralized control from mainframe hosts, depends heavily upon revenue from magnetic media, and requires the continuing pressure on Level II minicomputers (regardless of how sound they may be from an architectural and functional point of view). IBM's strategy creates an environment with significant, immediate opportunities for departmental software.

  - Minicomputer companies have grown because IBM has been reluctant to offload interactive applications from host mainframes. This opportunity continues during the SNA/DDP strategic period with one important difference--IBM's current strategy of offloading through "cooperative processing" may not proceed fast enough to keep the large host "dinosaurs" from falling under the weight of IBM's dual operating systems and DBMS strategy. The opportunity for the intelligent offloading of appropriate applications to Level II has never been better.

  - IBM may announce CD ROM for limited applications (such as education and micrographics replacement), but they cannot afford to offload

EXHIBIT B-3

IBM STRATEGIC PERIODS AND
IMMEDIATE DEPARTMENTAL SOFTWARE OPPORTUNITIES

IBM STRATEGIC PERIOD	IBM SOFTWARE EMPHASIS	IMMEDIATE DEPARTMENTAL SOFTWARE OPPORTUNITIES
Custom Products	All Including End-User Customized Systems	1. Off Load Host Applications 2. Support Optical Memories 3. Turnkey Systems
2000		
Expert Systems	Languages/DDS Industry Turnkey Applications Packages Data/Information/ Knowledge	4. Support Interoffice Communications and Network Management 5. Data/Information/Knowledge Management
1995		
Electronic Office	Languages/DDS Industry Turnkey Applications Packages	
1990		
SNA/DDP	SNA Operating Systems DBMS	
1986		

substantial data bases from the mainframe hosts because they are so dependent upon magnetic disk storage revenues for growth. The integration of optical memories into the storage hierarchy for office automation applications, as described above, represents a significant target of opportunity before IBM even gets out of the starting block.

- In Market Impacts of IBM Software Strategies, INPUT projected the need for early work on customized turnkey systems to support the Electronic Office strategic period and suggested that IBM would need all the help it could get when it started to turn its attention to that area. It was also pointed out that the integration of optical disks into office systems would require long lead times, and that such systems should be designed with the thought that IBM might eventually be one's best customer. (IBM's recent 20-year agreement with Hogan is an example of the potential IBM market for industry turnkey systems.)

- The primary characteristic of the Electronic Office is that it is communications oriented, and the Level IIs are the work units' gateways for both internal and external communications. For "corporate data" the departmental processor may connect with the large corporate mainframe (which has been reduced to a large data base machine), but it also must find necessary data where it exists and that may be on a public network. There is no need to go through Level I of the corporate network for such communications, and software for network and data/information/knowledge management should be designed accordingly. Departmental processors should provide necessary "connectivity" for their subordinate Level IIIs, and that connectivity will extend to other computer/communications networks. Users of workstations should not have to concern themselves with protocols for communications with the outside world.

- The Electronic Office will require new concepts of data and information management for purposes of storage, transmission, retrieval, and

quality assurance and, as everyone is talking about expert systems, knowledge must be included also. Software is required which will integrate data/information/knowledge (D/I/K), but it must recognize certain problems (such as entropy) and understand that they probably will require different models and management. Work units are also the appropriate level to address the problems of D/I/K quality in terms of integrity, synchronization, certification, and security, and software for departmental systems must address all of these considerations.

- In summary, there is a tremendous need for improvement in white collar productivity, and new technologies (specifically optical memories) hold the promise of effecting fundamental changes in the way business is conducted and humans communicate. There is a need for Level II minicomputers (departmental processors) between Level I mainframes and Level III intelligent workstations. The purposes of these departmental processors will be to differentiate the sets of data/information/knowledge required by a particular work unit and to integrate the flow of that data/information/knowledge. The primary purpose of these highly customized applications systems will be to maintain data/information/knowledge quality in an environment subject to changing roles for both technology and the human beings who are literally part of the network. IBM's strategy affords an ample window of opportunity, and IBM will need external systems and software support when it enters its Electronic Office strategic period in the 1990s.

APPENDIX C: USER QUESTIONNAIRE

APPENDIX C

USER QUESTIONNAIRE

INTRODUCTION

Hello, this is _____ calling from INPUT, a computer industry market research firm based in California. We are conducting a nationwide research project related to department software usage within large organizations and wanted to interview you as a part of this study. In exchange for a telephone interview with you we will be happy to send you a special summary of the results of the survey.

DEFINITIONS

For the purposes of our study the following definitions will apply:

1. DEPARTMENT: A work group of 3 or more people organized to address a common task within a unit that is part of a larger organization.

2. DEPARTMENTAL SYSTEMS: Automated systems that utilize multiuser hardware that is primarily under the control of the using department. Examples include: minicomputers, multiuser supermicros, PC-based local area networks, and micro-mainframe systems where the end user has significant local processing capacity and control. Excluded from our definition of departmental systems are standalone microcomputers and dumb terminals connected to central mainframes. Also excluded from our definition are multiuser systems, no matter what their size, that are the company's primary host computer. Applications for departmental systems are classified by INPUT into three types:

   A. GENERIC: Applications that address a common function independent of the user's department or industry. Examples are electronic mail and word processing.

   B. DEPARTMENT-SPECIFIC: Applications that are unique to specific types of departments, but are not unique to different industries. An example of a departmental-specific application is payroll.

   C. INDUSTRY-SPECIFIC: Applications that are unique to a specific industry. Examples include check processing systems for banks and material planning systems for manufacturers.

3. INTEGRATED APPLICATIONS: Applications that incorporate functions previously processed as separate, distinct programs. Integrated applications provide such features as a common command structure, data base access from multiple functions, and smooth switching between functions. A single integrated application may include multiple generic, departmental-specific, and/or industry-specific functions. Examples of integrated applications include accounting systems incorporating general ledger, payroll and accounts receivable as well as multifunction office sysetms such as DEC's All-In-1 or Data General's CEO.

OTHER NOTES REGARDING THE INTERVIEW

Some questions will ask for a response on a scale of 1 to 5. When this occurs, keep in mind that 1 is considered the lowest rating and 5 the highest rating.

RESPONDENT/DEPARTMENT PROFILE

1. Which of the following best describes your responsibility regarding the selection of automated departmental systems within your organization?

   _____ Decision Maker

   _____ Evaluator/Recommendor

   _____ Other (specify: _____) (Terminate interview.)

2. Which of the following best describes the nature of your involvement in departmental systems?

   Information Systems Professional (Full-time employment in I.S.)

   _____ Assigned to Corporate I.S. Department

   _____ Assigned to End-User Department (Go to Dept. respondent questionnaire.)

   End-User Department Employee

   _____ Department Manager

   _____ Other Type of Manager/Supervisor

   _____ Office Systems Manager/Analyst

   _____ Other (specify: _____)

3. Approximately what percent of your time in the past six months have you personally spent on automated departmental systems issues? _____%

   _____ Under 20% _____ 20% to 75% _____ Over 75%

4. How would you characterize your organization's use of departmental systems?

   _____ Leading Edge (in the top 10% of organizations within your industry in terms of extent and sophistication of use of departmental automated systems)

   _____ Near Leading Edge (in the top one-third)

   _____ Average

   _____ Below Average

5. What is the official name of your department? _____

6. What is the main function of your department?

_____ Accounting or Finance
_____ Administration
_____ Customer Service
_____ Engineering
_____ General Management
_____ Human Resources
_____ Information Systems
_____ Legal
_____ Manufacturing
_____ Research and Development
_____ Sales or Marketing
_____ Other (specify)_____

7. What type of department is this?

_____ Operations (part of organization's main line business function)

_____ Staff (supports the organization's main line business function)

_____ Other (specify)

_____

8. How many employees are in your department? _____ Number of employees

_____ Small (Less than 10 employees)

_____ Medium (10 to 50)

_____ Large (Over 50)

9. (If respondent is in an end-user department) What type of primary computer is used for departmental applications within your department?

Vendor and Model

_____

10. (If respondent is in the information systems department) What types of computers are used for departmental applications within your company?

Vendors and Models

1. _____
4. _____
2. _____
5. _____
3. _____
6. _____

(If respondent is assigned to an end-user department, skip to Question #13. Otherwise, respondent is a full-time I.S. professional assigned to I.S. department and Question #11 is next.)

11. Which departments within your organization are the most advanced in the use of departmental systems? (list in sequence beginning with most advanced)

    Dept. A: Dept. Name _____

    Size (Number of Employees) _____

    Type of Primary Computer Used for Departmental Applications:

    Vendor and Model _____

    Dept. B: Dept. Name _____

    Size (Number of Employees) _____

    Type of Primary Computer Used for Departmental Applications:

    Vendor and Model _____

    Dept. C: Dept. Name _____

    Size (Number of Employees) _____

    Type of Primary Computer Used for Departmental Applications:

    Vendor and Model _____

12. Why are these departments more advanced in the use of automated systems than others?

    _____

    _____

    _____

    _____

13. (If respondent answered "Leading Edge" or "Near Leading Edge" to Question#4) What accounts for your organization's leadership in the use of departmental systems?

    _____

    _____

    _____

    _____

    _____

14. Which of the following types of hardware configurations are most prevalent in the offices in your organization? (Rate each type according to its frequency of use, where 1 is "not used at all" and 5 is "used very frequently".)

CURRENTLY	IN 2 YEARS	
1 2 3 4 5	1 2 3 4 5	A. Standalone PC
		B. Connected Systems
1 2 3 4 5	1 2 3 4 5	1. Remote Mainframe with
		a. Dumb Terminals
1 2 3 4 5	1 2 3 4 5	b. Micro-Mainframe Connections
1 2 3 4 5	1 2 3 4 5	2. Departmental Mini or Supermicro Located within the Using Department
1 2 3 4 5	1 2 3 4 5	3. PC-based Local Area Networks
1 2 3 4 5	1 2 3 4 5	4. Other (specify) _____
		_____

15. Now we would like to ask you about any changes you anticipate concerning the volume of computer processing in your company. Let's use MIPS as a rough measure of processing volume. What would you estimate that the percentage change, if any, in MIPS for TOTAL COMPUTING CAPACITY will be in your company two years from now?

_____% change in MIPS two years from now for TOTAL COMPUTING CAPACITY

16a. What would you estimate the percentage change in MIPS for DEPARTMENTAL SYSTEMS will be for your entire firm during the next two years?

_____% change in MIPS two years from now for DEPARTMENTAL SYSTEMS

16b. What factors will contribute to this change in MIPS for departmental systems during the next two years?

_____

_____

_____

_____

_____

17. What are the three main departmental applications currently in use in your organization?

APPLICATION NAME	HARDWARE USED (VENDOR & MODEL)	SOURCE OF SOFTWARE SOFT. PROD.	IN-HOUSE
1.			
2.			
3.			

18a. Does your organization use or plan to use any of the following integrated office systems (IOS) products? (Check all that apply.)

	USING DEPT. (AND NUMBER OF USERS)	STATUS CODE*	SATISFACTION LEVEL (1 to 5)	NUMBER OF USERS IN 2 YRS.
_____ AT&T:				
_____ DEC: All-In-1				
_____ DG: CEO				
_____ HP: Personal Productivity				
_____ Honeywell: One Plus				
_____ IBM: DISOSS				
_____ IBM: PROFS				
_____ Wang: Wang Office				
_____ Sperry: SperryLink				
_____ Other				

(specify): _____

*STATUS CODE: E = evaluating, N = not using, P = plan to consider in next 12 months, U = in use now, DK = don't know.

(If respondent is evaluating, using or planning to use one or more of the IOS specified in Question #18a, ask Questions #18b and #18c.)

18b. What do you consider the positive and negative aspects of the integrated office system(s) cited above?

_____

_____

_____

18c. How important, on a scale of 1 to 5, is it that the IOS be integrated with department-specific and/or industry-specific applications?

1 2 3 4 5 DK NA REF

18d. Why? _____

_____

_____

_____

19. What new departmental applications are planned within your organization during the next 12 months?

APPLICATION NAME	TARGET HARDWARE	SOURCE OF SOFTWARE SOFT. PROD.	IN-HOUSE
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____

20a. To what extent does your organization use electronic mail (E-mail)?

_____ Using Now _____ Evaluating _____ Will Consider within 12 Months

(If Using Now):

20b. How many users do you have currently? _____

20c. How fast has usage grown in the past 12 months? _____%

20d. What factors account for this growth? _____

_____

20e. To what extent will usage change in the next 24 months? _____% change

20f. What factors account for this change? _____

_____

21a. How important, on a scale of 1 to 5 (with 5 being highest) will integrated applications be in the next 12 months to your organization?

1 2 3 4 5 DK NA REF

21b. (If answer is a 4 or a 5, ask WHY?) _____

_____

_____

22. What types of applications do you expect to see become more integrated in the future? Why?

_____

_____

_____

_____

VENDOR ISSUES

23. Which vendors impress you the most concerning current or future departmental systems solutions? Why?

_____

_____

_____

_____

_____

_____

OTHER ISSUES

24. Please rate on a scale of 1 to 5 the importance of the following decision criteria to the selection of departmental systems:

A. System reliability:	1	2	3	4	5	DK	NA	REF
B. Availability of department-specific or industry-specific applications software products:	1	2	3	4	5	DK	NA	REF
C. Capabilities of integrated office system software:	1	2	3	4	5	DK	NA	REF
D. Connectivity to IBM mainframes:	1	2	3	4	5	DK	NA	REF
E. Connectivity to other departmental systems vendors:	1	2	3	4	5	DK	NA	REF
F. Availability of tools for application development:	1	2	3	4	5	DK	NA	REF
G. Ease of use:	1	2	3	4	5	DK	NA	REF
H. System price:	1	2	3	4	5	DK	NA	REF
I. Other important decision criteria:	1	2	3	4	5	DK	NA	REF

(specify):

_____

25. What capabilities for departmental hardware or software do not currently exist that you would like to see become available?

_____

_____

26a. Has your organization undertaken any productivity improvement analysis related to departmental systems in the past 12 months?

_____ Yes _____ No _____ DK _____ NA _____ REF

26b. (If YES) What were the findings? _____

_____

27. Other comments or suggestions: _____

_____

_____

Thank you very much for your time.

APPENDIX D: VENDOR QUESTIONNAIRE

APPENDIX D

VENDOR QUESTIONNAIRE

INTRODUCTION

Hello, this is _____ calling from INPUT, a computer industry market research firm based in California. We aree conducting a nationwide research project related to department software usage within large organizations and wanted to interview you as a part of this study. In exchange for a telephone interview with you we will be happy to send you a special summary of the results of the survey.

DEFINITIONS

For the purposes of our study the following definitions will apply:

1. DEPARTMENT: A work group of 3 or more people organized to address a common task within a unit that is part of a larger organization.

2. DEPARTMENTAL SYSTEMS: Automated systems that utilize multiuser hardware that is primarily under the control of the using department. Examples include: minicomputers, multiuser supermicros, PC-based local area networks, and micro-mainframe systems where the end user has significant local processing capacity and control. Excluded from our definition of departmental systems are standalone microcomputers and dumb terminals connected to central mainframes. Also excluded from our definition are multiuser systems, no matter what their size, that are the company's primary host computer. Applications for departmental systems are classified by INPUT into three types:

   A. GENERIC: Applications that address a common function independent of the user's department or industry. Examples are electronic mail and word processing.

   B. DEPARTMENT-SPECIFIC: Applications that are unique to specific types of departments, but are not unique to different industries. An example of a departmental-specific application is payroll.

   C. INDUSTRY-SPECIFIC: Applications that are unique to a specific industry. Examples include check processing systems for banks and material planning systems for manufacturers.

3. INTEGRATED APPLICATIONS: Applications that incorporate functions previously processed as separate, distinct programs. Integrated applications provide such features as a common command structure, data base access from multiple functions, and smooth switching between functions. A single integrated application may include multiple generic, departmental-specific, and/or industry-specific functions. Examples of integrated applications include accounting systems incorporating general ledger, payroll, and accounts receivable as well as multifunction office systems such as DEC's All-In-1 or Data General's CEO.

OTHER NOTES REGARDING THE INTERVIEW

Some questions will ask for a response on a scale of 1 to 5. When this occurs keep in mind that 1 is considered the lowest rating and 5 the highest rating.

RESPONDENT/DEPARTMENT PROFILE

1. Which of the following best describes your responsibility regarding the development of MARKETING STRATEGIES for departmental systems sold by your company?

   _____ Decision Maker

   _____ Analyst/Recommendor

   _____ Other (specify: _____) (Terminate interview.)

2. Approximately what percent of your time in the past six months have you personally spent on product/marketing issues related to departmental systems? _____%

   _____ Under 20% _____ 20% to 75% _____ Over 75%

3. Now we would like to obtain a quick profile of the two highest revenue-producing products which you market and which run on departmental systems:

FACTOR	PRODUCT A	PRODUCT B
Product Name		
Product Type		
Key Facilities Features		
Computer Models and Operating Systems		
Date of First Installation		
Number of Installations to Date		
Price		
Primary Market Segments		
Main Competitors (Firm and Product)		
1985 Revenue		
1986 vs. 1985 Revenue (Percent Growth)		
1988 Revenue as a Percent of 1986 Revenue		

4. What are currently some major stimulants and obstacles to growth for the (cite product name)_____ _____ product mentioned above?

_____

_____

_____

MARKET PERCEPTIONS

5. In your opinion how prevalent are the following types of hardware configurations in departments in the U.S., and what will the relative popularity of these configurations be in two years? (Rate each type according to its frequency of use, where 1 is "not used at all" and 5 is "used very frequently".)

CURRENTLY	IN 2 YEARS	
1 2 3 4 5	1 2 3 4 5	A. Standalone PC
		B. Connected Systems
1 2 3 4 5	1 2 3 4 5	1. Remote Mainframe with
		a. Dumb Terminals
1 2 3 4 5	1 2 3 4 5	b. Micro-Mainframe Connections
1 2 3 4 5	1 2 3 4 5	2. Departmental Mini or Supermicro Located within the Using Department
1 2 3 4 5	1 2 3 4 5	3. PC-based Local Area Networks
1 2 3 4 5	1 2 3 4 5	4. Other (specify) _____

6. Now we would like to ask you about your perceptions concerning the volume and type of processing in computer installations across the United States. Let's use MIPS as a rough measure of processing volume. What would you estimate will be the percentage change, if any, in MIPS for TOTAL COMPUTING CAPACITY for all installations in the U.S. two years from now as compared to today?

_____% change in MIPS two years from now for TOTAL COMPUTING CAPACITY

7a. What would you estimate will be the percentage change in MIPS for DEPARTMENTAL SYSTEMS during the next two years?

_____% change in MIPS two years from now for DEPARTMENTAL SYSTEMS

7b. (If any change indicated) What factors will contribute to this change in MIPS for DEPARTMENTAL SYSTEMS during the next two years?

_____

_____

_____

8. Which type of companies and/or departments appear to be among the most advanced in the use of departmental systems?

_____

_____

_____

9. Why are these organizations and/or departments more advanced in the use of automated systems than others?

_____

_____

_____

10. Which departmental applications will grow the fastest in the next two years? Why?

_____

_____

_____

11. What in your marketplace has changed most noticeably in the past 12 months? Why have these changes occured?

_____

_____

_____

OTHER ISSUES

12. Please rate on a scale of 1 to 5 the importance of the following decision criteria to the selection of departmental systems:

A. System reliability:	1	2	3	4	5	DK	NA	REF
B. Availability of department-specific or industry-specific applications software products:	1	2	3	4	5	DK	NA	REF
C. Capabilities of integrated office system software:	1	2	3	4	5	DK	NA	REF
D. Connectivity to IBM mainframes:	1	2	3	4	5	DK	NA	REF
E. Connectivity to other departmental systems vendors:	1	2	3	4	5	DK	NA	REF
F. Availability of tools for application development:	1	2	3	4	5	DK	NA	REF
G. Ease of use:	1	2	3	4	5	DK	NA	REF
H. System price:	1	2	3	4	5	DK	NA	REF
I. Other important decision criteria:	1	2	3	4	5	DK	NA	REF

(specify):

_____

13a. How important, on a scale of 1 to 5 (with 5 being highest), will integrated applications be to the market in the next 12 months?

1 2 3 4 5 DK NA REF

13b. (If answer is a 4 or a 5, ask WHY?) _____

_____

_____

14a. How important, on a scale of 1 to 5, is it that the integrated office systems be integrated with department-specific and/or industry-specific applications?

1 2 3 4 5 DK NA REF

14b. Why? _____

_____

_____

15. What types of applications do you expect to see become more integrated in the future? Why?

_____

_____

_____

COMPETITIVE ISSUES

16. What has changed most noticeably about the competitive situation in your marketplace in the past 12 months?

_____

_____

_____

17. Who is your strongest competition? Why? _____

_____

_____

_____

18a. Is your strongest competition today the same as it was 12 months ago?

_____ Yes _____ No _____ DK _____ NA _____ REF

18b. (If NO) What has changed and why? _____

_____

_____

_____

19a. Are there any competitors that you consider "up and comers" (i.e., they may not be strong now, but they seem to be making good progress)?

_____ Yes _____ No _____ DK _____ NA _____ REF

19b. (f YES) Who are they? What have they been doing that works for them?

_____

_____

_____

20a. Have any of your competitors changed their market strategies recently?

_____ Yes _____ No _____ DK _____ NA _____ REF

20b. (If YES) who changed? What was altered and why?

_____

_____

_____

21. Which vendors impress you the most concerning current or future departmental systems solutions? Why?

_____

_____

_____

_____

22a. To what extent will new connecting/linking developments impact your product and market strategy during the next two years?

___Much ___Some ___Little ___None ___DK ___NA ___REF

22b. (If answered Much or Some) Which new communications developments will impact your strategy the most? Why?

_____

_____

_____

_____

OTHER ISSUES

23. What capabilities for departmental hardware or software do not currently exist that you feel users would like to see become available?

_____

_____

_____

_____

24. Other comments or suggestions?

_____

_____

_____

_____

_____

Thank you very much for your time.

APPENDIX E: RELATED INPUT REPORTS

APPENDIX E: RELATED INPUT REPORTS

A. ANNUAL MARKET ANALYSES AND INDUSTRY SURVEYS

- U.S. Government Procurement Analysis Reports, GFY 1986-1991.
- U.S. Information Services Vertical Markets, 1986-1991.
- U.S. Information Services Cross-Industry Markets, 1986-1991.
- Directory of Leading U.S. Information Services Vendors.

B. OFFICE INFORMATION SYSTEMS MARKET REPORTS

- Analysis of User Requirements for Office Products, 1983.
- IBM Operating Systems Directions, 1986.
- Management, Technology, and Strategy for Office Products, 1983.
- Micro Software Support Strategies, 1984.
- Office Products Vendor Competitive Analysis, 1983.

- Office Systems Service Market Analysis and Forecast, 1985-1990.
- Selling Personal Computer Software to Corporate America, 1985.
- U.S. Personal Computer Software Market, 1984-1989.

C. OFFICE INFORMATION SYSTEMS PLANNING

- Cost/Benefit Analysis for Office Systems, 1983.
- Decision Support Systems: Experiences and Outlook, 1985.
- Decision Support Systems and Beyond, 1984.
- Executive Workstations: Problems and Outlook, 1984.
- Integrating Office Systems into the Organization, 1985.
- Intelligent Workstations: Connecting the End User, 1985.
- Local Area Networks: Directions and Opportunities, 1983.
- Training: Prerequisite to Successful End-User Computing, 1985.